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historic structure report

architectural data section

september 1984

Pkg. 103

SPRINGFIELD ARMORY

NATIONAL HISTORIC SITE/MASSACHUSETTS

Prepared and published by the Denver Service Center

HISTORIC STRUCTURE REPORT

Architectural Data Section

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

Massachusetts

by
Robert L. Carper
and
Richard G. Turk

U.S. Department of the Interior / National Park Service

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PREFACE

The history of this Historic Structure Report for Springfield Armory National Historic Site began with the preparation of the historical data section and historical base map by John Albright, Historian, starting in the summer of 1976 with publication in May 1978.

This architectural data section was begun by Robert L. Carper, architect, in the fall of 1976 with completion of the first draft in August 1978. The subsequent regional and park review in December 1978, resulted in the need for several modifications to the text.

1. Removal of general planning alternatives, since they are better developed in the appropriate planning document, i.e., development concept plan.

2. Reorganization of the report to clarify the evolution of the structures and to improve the readability of the document.

3. Updating of treatment recommendations to reflect recent information and the refinement of management goals.

It is at this point in time that Richard Turk was assigned responsibility for all work at Springfield Armory National Historic Site, including revision of Mr. Carper's draft architectural data section. Due to priorities for the obligation of construction funds first available in the fall of 1978 and other national priorities, revisions were delayed until the fall of 1982.

This final document attempts to resolve the earlier comments on the Carper draft and update the recommendations. The document is a synthesis of Carper's work, Turk's own analysis, and revisions.

During the process of preparing the initial draft, Mr. Carper received generous help from park, region, and DSC staff. Of particular help were

William Meuse, park curator, and John Albright, author of the historical data section. Assistance was also provided by members of the community and previous Armory employees. Special thanks to Thomas Wallace, museum curator, City of Springfield, for his insights into the operations of the Armory before closure.

The process of revising and updating the initial draft has involved numerous people. The general assistance and support offered Mr. Carper by the park, region, and DSC staffs has continued to be offered during the revisions. Stull Associates' preparation of supplemental reports for the historic structure report is greatfully acknowledged. Robert L. Carper has continued to be of help throughout the preparation of this revised document and has accepted any editorial changes with grace and good humor.

This report may suffer some of the problems associated with documents prepared over a long period of time with multiple authors and editors; however, it also offers the reader a broad viewpoint of the proposed treatment of one historical site.

Richard G. Turk
November 1982

I. INTRODUCTION

A. Historic Significance

The year 1777 saw the beginnings of arms manufacturing at Springfield, Massachusetts. Formally established by Congress in 1794, Springfield Armory was a significant center of manufacturing and development of military small arms for nearly 200 years. Most United States armed services small arms were developed in the laboratories at Springfield Armory. As envisioned by two of the Armory's most important commanding officers, Roswell Lee and James W. Ripley, the grounds and buildings embody this importance. Designated as "The National Armory" in 1876, Ripley's hope for this title came true, but not during his tenure as commanding officer. The Armory was deactivated in 1968. It was designated as a National Historic Landmark of National Significance on June 22, 1961. Springfield Armory National Historic Site was established by the 93rd Congress under Public Law 93-486, approved on October 26, 1974.

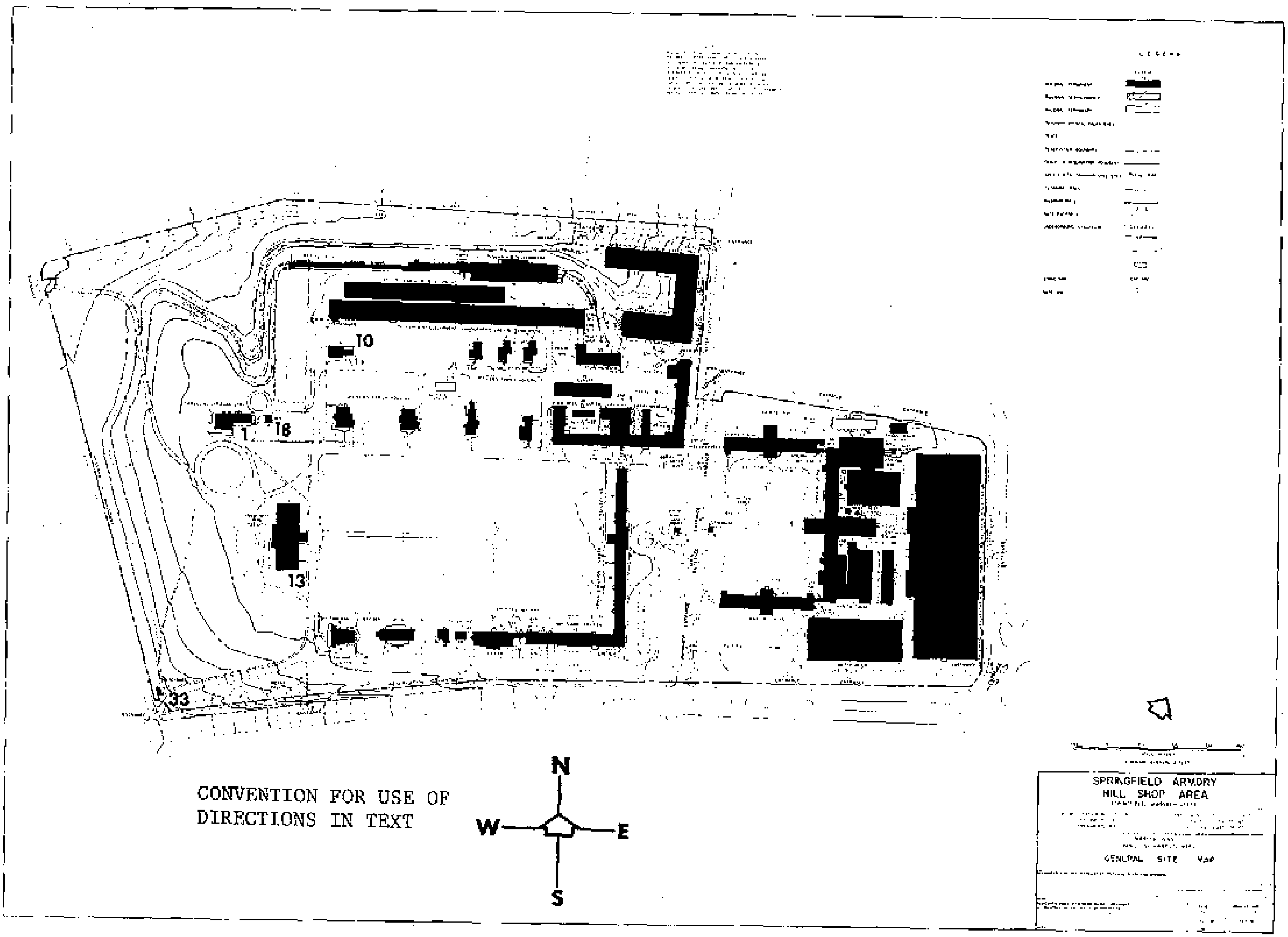
Some important dates and developments pertaining to the buildings and grounds within the national historic site are included here:

1833	Construction of Master Armorer's House (Building 10)
1845-47	Construction of Commanding Officer's House (Building 1)
1847-51	Construction of Main Arsenal (Building 13)
1847-c. 1864	Construction of fence
1850	Flagstone walks possibly date from this year
c. 1852	Exteriors of Buildings 1 and 13 painted. Water lines installed to Buildings 1 and 10 (Building 1 may have had water service when built). Gas line installed around square.
c. 1870-75	Main gate moved to corner of State and Byers streets, new road built from gate up hill.
1875-76	New gatehouse
1876	Stone monument erected south of Paymaster's House. Centennial or Civil War memorial

1877-82	Building 10 moved. (Master Armorer's House)
c. 1877-84	Original porches still on Building 1 (shown in 1877 map, c. 1876 photograph, and c. 1884 illustration)
1885-1900	Lighting and water improvements (post still lighted by gas in 1892)
1886	Map shows Building 10 moved, but still retaining rear section
1897	Hydraulic (water-powered) elevator installed in Building 13
1899	Map shows new road behind Building 13; rear section of Building 10 not shown
1900-15	Water, sewer, gas, and electrical installations and modifications
1902	City water installed to Buildings 1 and 10. Building 10 was then hospital
1906	Buildings now had steam heat from steam plant; electric light plant and gas generator served site; additional city water (8 inch line from State Street)
1908	Present gatehouse (Building 33) replaced 1875-76 gatehouse
1912-13	Fire sprinkler system installed in Building 13
c. 1932	Building 10 still has chimneys and shutters; tennis court on west side of Building 13 in existence by this year
1937	WPA repairs on Building 10. Garage (Building 18) built
1940 or 41	Loading dock built in base of tower of Building 13

B. Planning Background, Proposed Building Use, and Mitigations

Robert Carper's initial draft was prepared at a time when no significant planning decisions, concerning future site development, had been made. The Statement for Management was only in draft form. A general management planning effort had been abandoned. The development concept planning effort had not begun. As a result the initial draft presented many planning alternatives and assumptions, required to prepare the historic structure report.



1962

Illustration I
Springfield Armory National Historic Site, Hill Shop Area
U. S. Army, Corps of Engineers Drawing, NPS Park Files

1962

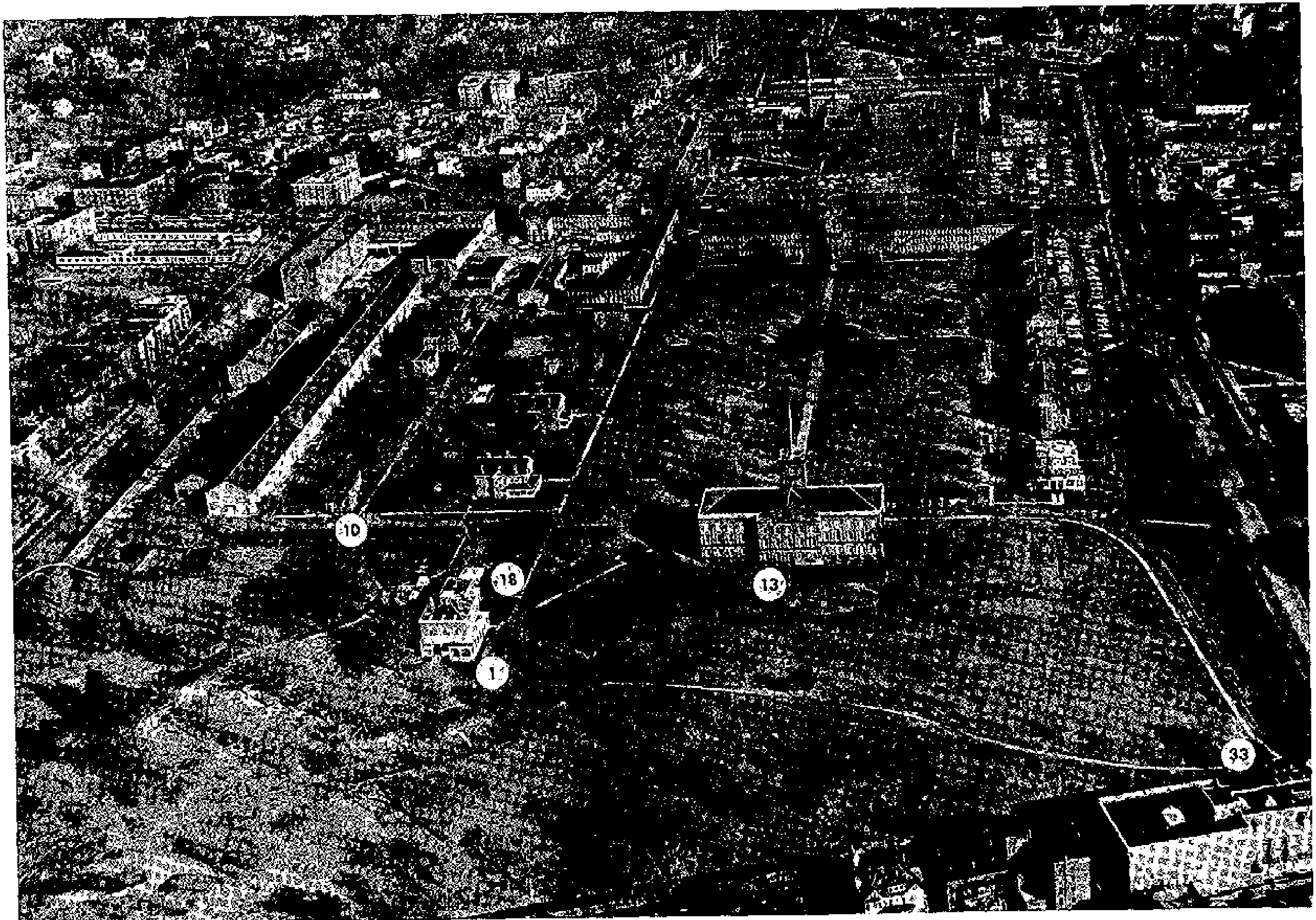


Illustration 2
Springfield Armory National Historic Site, Aerial View from the West
U. S. Army Photograph, Negative 19-058-68/AMC-65, NPS Park Files

1968

1968

Today the planning climate is significantly altered. The Statement for Management still remains only in draft. Completion of the development concept plan has been deferred, pending renegotiation of the National Park Service-Springfield Technical Community College cooperative agreement. However, region and park management have made basic decisions,[1] which allow recommendations to be more focused and specific than those in the initial draft. These basic decisions can be summarized as follows:

1. <u>Period of Restoration</u>

A restoration period of the closing of the Armory in 1968 was selected. In general the existing conditions in 1982 reflect conditions in 1968. Selection of this period means that no existing additions to the building exteriors will be removed, i.e., 1941 loading dock and no site feature reconstructions would be considered.

2. <u>Building Use</u>

a. <u>Main Arsenal, Building 13</u>

The building is to be adaptively used to house the arms collection, as it is now. The proposed building functions include interpretive exhibits, audio/visual presentations, collection storage, library, curatorial work, and park administration. In order to accommodate these functions, new utility systems, gas and electricity, are required; new heating, ventilating, and air conditioning (HVAC) systems will be added; fire egress and handicapped access modifications are required, the existing elevator will be replaced, and new security systems added. These functions will be housed in the basement and on the first and second floors. The third floor will remain vacant.

b. <u>Commanding Officer's House, Building 1</u>

The existing park administrative headquarters is to be moved to Building 13. The house is then to be leased to community

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1. Trip report, June 12, 1981; Associate Regional Director, Planning and Resource Preservation. See Appendix C.

groups or enterprises. New electrical and gas service and new HVAC systems will be required to support this new function or any other function.

c. Master Armorer's House, Building 10

Short-term use of the structure by the Springfield Police Department is anticipated. Continued leasing of the structure to the police or other groups is proposed.

d. Garage, Building 18

The building will continue to be used for a garage and storage.

e. Gatehouse, Building 33

No specific use is proposed, but the structure should be stabilized.

f. Fence

Repair and replacement of damaged sections of the fence is required. Segments of the foundation also require repair.

3. Mitigations

All the NPS-administered structures were placed on the National Register with the formation of the historic site or district. The qualities for which the structures were placed on the register were the exterior facades and their contribution to the site's historic scene. The only reference in the register forms to significant interior qualities of the buildings is to the spiral tower stair in Building 13. This is not to say that the building interiors are without value, but there is slightly more leeway for modifications required for adaptive use.

Given the selected period of restoration of 1968 all exterior preservation and stabilization work will constitute actions which have no effect upon the exterior appearance of the structures. The performance goal for exterior work is to produce a weathertight envelope through repair and replacement in kind of deteriorated building fabric. Examples of the type of work would be replacement of deteriorated copper flashing, repair or replacement of damaged slate roofs, repair of damaged window assemblies, repointing of masonry, and replacement of damaged structural members. All of the above work would be performed without altering the historic appearance, and could be considered preservation maintenance.

The next level of mandatory work required involves replacement and updating of park utility services, specifically electrical and gas; and Building 1 and 13 heating systems. Such work will impact the historic site and structure, but will have "no effect" upon the qualities for which Springfield Armory was placed on the National Register. Ground disturbance will be necessary for construction of new utility services, requiring archeological testing of routes. Impacts on building interiors would be minimized where system operations would allow. Equipment which visually intrudes would be located so as to minimize visibility from within the historic site, particularly the historic core of the site.

The adaptive use of the NPS-administered structures will constitute a significant impact upon the building interiors, through increased daily wear and through modifications required to house the new functions. Only limited exterior impacts are anticipated from required vents and required fire exits, whose impact can be minimized through proper design. Building 13, given its more complex proposed use, will suffer greater impact. However, in all cases the goal would be to save and protect historic fabric where possible, while providing for the new function. Since all significant impacts affect only building interiors, adaptive use should have no effect upon the qualities which placed the structures on the register.

The primary mitigation for any of the actions discussed above is that such work will allow for the protection and care of the arms collection and the display of the collection to the public. It must be remembered that the primary reason for the park's existence is the arms collection.

C. Report Organization

Within the above planning framework and mangement decisions, each historic structure at Springfield Armory National Historic Site has been analyzed and discussed. Mr. Carper's initial research has been supplemented from several sources during the long gestation period for this document. Stull Associates, an architectural firm, was hired, due to heavy work loads in 1978, to supplement Mr. Carper's historic structure report and to prepare contract documents for Fiscal Year 1979 construction funds. The supplementary reports focused on issues related to the building systems, e. g., electrical, HVAC; and also expanded the original existing conditions survey. Preliminary design reports prepared were as follows:

"Building Systems Analysis and Recommendations" and "Report Update"

"Material Conditions Survey and Recommendations"

"Paint and Mortar Analysis"

"Commanding Officer's House, Historic Heating System"

These documents, in conjunction with the Carper report, led into contract documents for exterior stabilization work and new utility service to Buildings 1 and 13. Excerpts of the reports and discussion of the construction contracts can be found in the appendix.

This document is an amalgam of the Carper report, the Stull reports, and the author/editor's own analysis. The document is structured in the following general format.

1. General Description and Evolution - The existing structure is described in general terms and the building's major evolutionary changes discussed.

2. Existing Conditions - A detailed existing conditions survey of the structure is presented, any significant building problems identified, and possible causes and solutions for the problems discussed.

3. Recommendations - Recommendations for building treatment and the correction of specific building problems are presented. The recommendations are a synthesis of Carper's recommendations, Stull Associates recommendations, and analysis by the author/editor.

4. Photographs - Historic and existing conditions photographs are presented. Existing conditions drawings are located at the back of the report.

Following the sections on each building, general issues applicable to all structures, i.e., handicapped access, and code compliance are discussed.

ARSENAL - BUILDING 13

II. THE MAIN ARSENAL, BUILDING 13

A. General Description and Evolution

One of the primary expressions of Lt.-Col. James W. Ripley's grand design for Springfield Armory was undoubtedly the Main Arsenal. It provides the visual terminus of the west end of the square, its tower reflecting that of the administration building at the opposite end of Armory square.

To initiate his development plan, Ripley had removed the first Commanding Officer's House in 1843, which was on the site of the Main Arsenal.[1] But the Main Arsenal was not begun immediately. Instead, the new Commanding Officer's House (Building 1) was started in 1845.[2] When that house was nearing completion, construction of the Main Arsenal was begun, in 1847.[3]

Excavations were begun in the spring of that year, and in 1849 it was reported that the building was ready for the roofing and reception of gun racks and the clock placed in the tower.[4] In 1850, the tower and roof were finished along with the installation of copper lightning conductors. Of particular interest was the oiling of the exterior walls, possibly with linseed oil and turpentine, as a moisture-proofing treatment. Several years would elapse before painting to allow the masonry to dry. On the interior it was reported that the cellar was paved (probably brick), lathing and plastering was completed and gun racks were being built.[5]

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1. Albright, John, Historic Structure Report, Historical Data and Historical Base Map, Springfield Armory National Historic Site, Massachusetts, U.S.D.I., N.P.S., D.S.C., Denver, Colorado, May 1978, pp. 23, 24.

2. Ibid., p. 26.

3. Ibid., p. 26.

4. Ibid., pp. 29-30.

5. Ibid., p. 31.

Interior finishing continued through 1850, second floor gun racks were completed, and the ones for the third floor in progress. Interior painting was being done in 1851.[6]

The building was probably finished in 1851.[7] About 1852, the exterior (and the commanding officer's house exterior) were painted salmon color.[8]

Except for these items, there is very little descriptive information of the building construction. If construction records exist, they have not been brought to light.

The Arsenal has experienced only minor changes since its completion in 1851. None of the changes significantly altered the basic building form or structure. The following exterior changes occurred:

1.	Loading dock constructed in tower	1940-41
2.	Fire escapes	1940s
3.	Exterior color changes	c. 1852, c. 1880, c. 1937

The Arsenal experienced several interior modifications:

1.	Elevator installed	1897
2.	Restrooms	n.d.
3.	Sprinkler system installed	1912-13
4.	First floor partitions by Army	1940s
5.	Basement partitions by television studio . .	1970s

The imposing scale of the building expresses a strength appropriate to its original function--the storage of arms required solidity. There is a strong expression of both the vertical and horizontal elements

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6. Ibid., pp. 32-33.

7. Ibid., pp. 39-40.

8. Ibid., p. 40.

of the building's facades. Strong horizontal lines are expressed by the stone water table, creating a base for the building, by the stone stringcourse at the second floor line, by the three tiers of windows, and by the stone and brick entablature. Vertically, the windows and brick pilasters express the regularity of the building's structural bays (five bays wide and fifteen bays long). The proportions, symmetry, and development of the fenestration reflect a revival of the classic renaissance.

Overall exterior dimensions of the building are approximately 69 feet in width, 199 feet in length, and from grade to the cornice is nearly 50 feet. The tower at the center of the east front is 28 feet, 6 inches wide, projecting about 26 feet from the main wall. From grade to the tower roof is 84 feet 6 inches. The gable-roofed pavillion on the west front is approximately 69 feet wide and projects 12 feet from the building face.

Undated elevation drawings show details differing from those of the building. A portico is shown on the west side, for which physical evidence cannot be found.[9] The third floor windows are shown with a pedimented lintel, whereas the actual lintels are flat. At second floor windows, the drawing shows the projecting brick jamb portions of the architrave starting at the window sill rather than at the stone stringcourse.[10] Whether the drawing was done in error or was done prior to construction of the building is not known.

Roofing is slate on tongue and groove board sheathing on both the main hip roof and the pavillion gable. The flat tower roof has asphalt-coated fabric over an earlier flat seam metal roofing. This tower roof area is surrounded by a crenalated stone parapet. The snow rail

9. See Illustration 3.

10. See Illustration 3.

along the main roof eave is wooden, detailed to provide a visual link to the main wall pilasters.

Exterior brick is uniform red color. The water table, stringcourse, pilaster caps, cornice, and window heads and sills are red sandstone.

Window frames and sash are wood. Second and third floor windows are 12 over 12 lights, double hung, but first floor windows are 8 over 8 lights, double hung with a fixed round arched overlight. Basement windows are casement, four lights each sash.

The only entrance to the building are the large doors on each side of the tower. The wood doors were cut off when the concrete loading dock was added in the base of the tower (c. 1941).[11] The tower floor level was thus brought up to the first floor level of the main building. The only vertical circulation other than the elevator in the building is the spiral stairway of the tower, an impressive sight to the visitor.[12]

Except in the basement where the structure is exposed, the ceilings were originally plastered. Lathing is secured to the bottoms of the floor joists on first and second floor ceilings. The lath and plaster ceiling of the third floor was applied to wood nailers suspended from the attic floor joists with wood hangers. At a later time, pressed metal panels were applied over the plaster ceilings.[13] Other than in the basement, the exterior walls were plastered and painted.

The structure of the main and pavillion roofs consists of timber rafters, purlins, and trusses. The queen post roof trusses span the

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11. Albright, p. 98.

12. See Illustration 14.

13. See Illustrations 24 and 25.

entire width of the building, providing unobstructed space on the third floor except for the elevator shaft. The wood flooring and joists of the attic are carried by the lower chords of the trusses.

First, second, and third floors are finished with wood tongue and groove flooring and subflooring on wood joists. The floor loads are carried by timber beams running across the building, all interior loads then being carried vertically by cast iron columns to bearing at the basement floor level. Columns are 13 feet on center each way. Columns carrying second and third floor loads are cross or cruxiform in section, those carrying first floor loads are round, fluted, and having a Doric capital. The exterior brick walls carry the loads from the roof and from the perimeter bays of each floor.

B. Existing Conditions - Exterior

1. Masonry

a. Brickwork

The exterior red brick is laid with lime mortar in running bond with no headers except at corners and projecting courses. The exception is the brickwork of the entablatures and friezes on both the main building and the tower which is Flemish bond. The average brick size is 2-3/8 inches by 3-7/8 inches to 4 inches by 8-1/4 inches. Mortar joints are 1/4 inches.

Shortly after the construction of the building, the brickwork was painted, and it remained painted until about 1937. The first color was salmon, later the color scheme was changed to yellow ochre and red-brown. The red-brown was used on the brickwork of the main wall and window pilasters, and the entablature. This emphasized horizontal and vertical elements, the color blending with the stone, and the wall panels created reflected the bays of the building's structural system.[14] The sandstone was not painted in either color scheme.

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14. See illustrations 5, 6, and 7, both show the yellow ochre and red-brown color scheme.

The brickwork in the pediment of the pavillion exhibits a curious color variation. A band with a slightly darker color can be seen beneath the cornice, the lower edges intersecting the upper portion of the clock face. These bands also appear in a pre-1899 view of the building[15] indicating that these portions were painted red-brown rather than yellow ochre. The remnants of this dark color remaining in brick and mortar pores may account for the continuing visibility of the darker bands.

About 1937 the paint was removed by sandblasting.[16] This removed the hard, protective surface of the brick, exposing voids within the material. Though the increased porosity should have made the brick much more susceptable to water penetration and damage, little evidence of increased deterioration can be noted. The sandblasting also removed the surface of the mortar joints. The joints were probably tooled flush to provide a smooth appearance when the walls were painted.

The brickwork above the water table and stringcourse receives considerable moisture from the splash of wind-driven rain on the tops of these elements. Mortar erosion is most prevelant here.

Efflourescence can be seen in some areas. At the tower base, for example, some six courses of brickwork and the stone of the water table both exhibit efflourescence and spalling. Some brick at the southeast corner of the tower have disintegrated.

Another problem in recent years contributing to deterioration has been ivy growth on the walls. During initial park operation in 1977, the ivy was removed, except for plant tendrils which had penetrated mortar or attached to the brick.

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15. Ibid., Illustration 7.

16. See Illustration 23. Photograph shows sandblasted brick surface.

b. Stonework

Red sandstone was used for the water table (wall facing above grade), stringcourse, cornice, pilaster caps, window sills, lintels, and arched architraves, arched door architraves, at clock openings, and the tower parapet. The stone was precision cut and finished smooth with no tooling pattern. Lime mortar was used to set stone with joints not greater than 1/4 inch. Mortar was tooled flush. Stonework was never painted.

Brick pilasters and windows of the tower reflect those of the main building. Similarly, the stone water table, stringcourse, and cornice on the faces of the tower continue the horizontal lines of the main building. The crenelated sandstone roof parapet terminates the tower, and the pediment of the west front gable end is outlined in stone.

The condition of the stonework is good except for staining and some areas of efflourescence and spalling. The staining has occurred from the combined action of atmospheric pollutants and moisture. Efflourescence and spalling on the water table stone are the effects of wind-driven rain, splash from the ground, salt used during the winter, and rising damp. This stone element is the most susceptible to moisture effects.

Mortar erosion has also contributed to moisture penetration. This is particularly true of the vertical joints of the upper course of stone in the water table, allowing moisture to penetrate the stones of the next course below. Freeze-thaw action has then caused hairline cracks.

2. Roofing

The gray slate roofing is undoubtedly not original and there is no evidence as yet indicating how many replacements have occurred. The existing slate may be as late as the 1930s, at about the time the Commanding Officer's House was reslated. Leakage has occurred, but 1977 repairs seem to have been effective and the slate appears to be in generally good condition. Some possibility of structural deterioration due to the leakage exists.

The existing roofing on the flat roof of the tower is an asphaltic saturated fabric applied over an earlier flat seam metal roofing. There are low areas in the roof surface. Standing water has increased the duration of leakage resulting in interior deterioration, particularly ceiling plaster on the clock level, a great deal of which has fallen. Television station antennas anchorages and other equipment has contributed to the leakage. It is assumed that antennas will be removed when the television station moves to new quarters.

3. Flashings, Gutters, and Downspouts

Ridge and hip caps, valley and other flashings are copper or lead-coated copper. Eave flashing and the gutter liners also appear to be lead-coated copper. These materials may be those applied at the time of the latest reroofing, possibly as late as the 1930s.

Downspouts are fed directly through the cornices from the gutters. The age or historic authenticity of the existing downspouts was not determined. The downspouts feed directly into subsurface drains but these are clogged with silt and vegetative debris, rendering them ineffective. This contributes to rising damp in the stonework at the base of the building. This is particularly true at the corners where the tower and pavillion join the main building. These locations tend to collect wind-blown leaves and trash, inhibiting drainage away from the building.

Deteriorated seams and joints in the downspouts cause flooding of the building walls, eroding mortar, and causing excessive penetration of water into the brick and stone.

4. Snow Rail

Although the existing wood snow rail may not be the original, it is probably of the original design.[17] The elements reflect the regularity of the wall panels and pilasters of the building. The rail is held in place with metal brackets anchored to the roof. This anchorage

17. See Illustrations 16 and 22.

is a source of water leakage, but the snow rail is needed today for the same reason it was historically. It prevents snow from sliding off the roof and injuring people.

Many portions of the snow rail are in poor condition. It is entirely missing on the west elevation from the south corner of the building to the pavillion.

5. Windows

Wood window frames and sash are all in need of repair and refinishing. There has been no maintenance for years, resulting in conditions of deterioration. Many wood surfaces are exposed to sun and water, and is rotting or cracked and very dry. Putty will not bond as the dry wood pulls out the oil before it can cure properly.

A water intrusion problem exists at basement windows. The sills are at grade level, and an attempt was made at some time to alleviate this problem by adding a concrete curb. Although ground surface water is held away, rain and snow fall into the narrow space between the curb and window. Leaves and wind-blown dirt also accumulate here. Water not only causes rot in the wood window frames and sash but also penetrates the brick walls of the basement.

6. Exterior Illumination

It is not known whether any elements of the exterior lighting date from c. 1906, when electricity was installed at the Armory.[18] The two fixtures on the front of the tower appear to be the earliest of the existing lights, but they were not on the building before the loading dock in the tower base was built. The globe is missing from one of these fixtures. Spotlights mounted on the snow rail, lighting the upper portion of the tower, are also of a more modern period. Utility spots and conduit over the tower entrances are fairly recent.

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18. Albright, p. 78.

7. Lightning Protection

The original copper lightning conductors were installed in 1850.[19] Most of the existing system is historic but may not be the original. There are nine air terminals on the ridge of the main roof of the building, two on the pavillion ridge, and others on the tower. In recent years the system was not entirely functional, as many down conductors (braided cable) were not secured to the ground rods. The system was repaired in 1977, some parts having been replaced. The system is now reported to be functional.

8. Loading Dock

The concrete loading dock addition at the sides and within the base of the tower was constructed in 1941.[20] The configuration of the paved vehicle access was probably changed at this time. The existing concrete paved access way extending along the front of the building on both sides of the tower did not exist before the loading dock was built. Prior to the loading dock, a curved, paved drive led to the doors on each side of the tower. This semi-circular drive arrangement appears to have existed from at least the year 1864 until about 1941, appearing on maps dated 1864,[21] 1877,[22] 1904,[23] and 1910.[24] On an 1851 map,[25] however, rectangular loading areas are shown extending well beyond both ends of the building.

The construction of the loading dock required door modifications. The bottom sections of the two large doors on each side of

19. Ibid., p. 31.

20. Ibid., p. 98.

21. Ibid., p. 51.

22. Ibid., p. 65.

23. Ibid., p. 79.

24. Ibid., p. 81.

25. Ibid., p. 37.

the tower were cut off to fit the new openings. Additional modifications were made then, or perhaps later. The south door was fitted with rollers and mounted on an overhead track. A small door was cut into the large left leaf of the north door.

The construction of the loading dock caused modifications in the tower interior. An access stair and doorway at the southwest corner leading to the basement was blocked, a stair and landing at the entrance to the main building entry was eliminated, and the lower end of the spiral staircase was either covered or removed. The main interior entry doors have also been replaced, although this may have occurred later.

9. Tower Roof Safety Railing

The existing wood and wire mesh railing around the inside of the tower parapet is poorly anchored and an ineffective safety railing, as well as being a visual intrusion.

10. Clock and Clock Faces

The upper section of the tower has a clock face on each of the north, east, and south faces.[26] The fourth clock face is in the pediment of the pavillion. The west face of the tower has a circular window in the same position as the clock faces on the other sides. The clock faces correspond to the floor level on which the clock mechanism is located. A system of drive rods extend from the mechanism to the clock hands. The drive rod for the pavillion face clock extends across the attic from the tower, a total of approximately 80 feet.

11. The Bell

The mellow tolling of the bell located on the tower roof was probably familiar to Armory workers and Springfield citizenry for many years. The bell diameter at the base is 3 feet 7 inches and was cast

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26. See Illustration 19.

about three years before the building was completed. Identification was cast prominently on the bell: "FROM MENEELEY'S FOUNDRY, WEST TROY, N.Y., 1848."

12. Flagpole

A flag appears to have flown above the Arsenal since construction, since tower roof framing was designed to support the pole. Construction was probably wood, but no specific details about the early pole is known. Illustration 4 appears to indicate construction similar to ships masts. In March 1943, a wood pole which had stood since 1919, was replaced with a new wood pole. The new Douglas fir pole was 67 feet tall, built in two sections like a ships mast. A wood ball capped the pole, replacing a metal ball on the previous pole. This pole was then replaced again, with a metal pole, toward the end of the Armory's operation.[27]

13. Intrusions

During the years after closure of the Armory several minor additions were made which can be termed intrusions into the historic scene.

a. With the use of a portion of the Arsenal as a television studio, antennas and window air-conditioning units were added. These intrusions were removed with the departure of the television station in 1980.

b. The first floor window in the south end of the pavillion has been replaced with a door to provide a fire escape.

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27. Springfield Armory National Historic Site, Newspaper Clipping File, 1943.

C. Existing Conditions - Interior

1. Building Structural System

Except for columns, the elevator shaft and modern day partitioning in the basement and first floor, the building interior is clear space.[28] There are no columns on the third floor. First and second floor interiors measure approximately 62 feet 2 inches by 192 feet 8 inches. The third floor is slightly larger at approximately 62 feet 8 inches by 193 feet 3 inches.

The existing clear height from the basement floor to the bottom of the timber beams is only 6 feet 9 inches, but on first and second floors is approximately 12 feet 9 inches. The third floor clear height from floor to ceiling is approximately 16 feet 3 inches.

Besides the spaciousness of the building, the interior structural system is striking to the observer. There are no columns in the third floor space since the ceiling and attic floor are carried by the roof trusses. The cast iron columns supporting the second and third floors are impressively slender, with an interesting cruxiform cross section.[29] Floor loads are carried by 5 inch by 10 inch timber joists at approximately 1 foot 9 inches on center, which bear on double 6 inch by 16 inch timber beams supported by the columns. These main beams run across the building only, spaced at 13 feet. Column spacing is 13 feet each way. Basement columns are round, fluted, having a neo-Doric capital.[30] These cast iron columns are probably hollow. A bearing plate fitted over the top provides not only beam bearing but direct bearing from the columns above. The cruxiform section of the first floor columns merges into a rectangular section between the double beams. This 2-1/2 inch by 7-1/4 inch cross-sectional area transfers the load to the basement columns.

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28. See Illustrations 26 and 27.

29. See Illustration 34.

30. See Illustrations 28 and 33.

This bearing area may seem small, but is quite adequate for heavy floor loadings. Other factors will control the floor loading limitations, one being the relationship of column length to width. Preliminary structural analysis of the building indicates that the capacity of the framing to carry the loading of museum exhibits should be no problem, but bases are recommended to spread out the load of heavy items. Unless a more detailed analysis provides contrary results, floor loading is recommended to be limited to 100 pounds per square foot.

The roof trusses spanning the width of the building are also spaced at 13 feet.[31] The clear span is 62 feet 8 inches; truss bearing is on the brick walls. Rafters are 3 inches by 7 inches at approximately 1 foot 10 inches on center. These are carried by 7 inch by 10 inch timber purlins, which transmit the loads to the trusses. The timber truss joints are mortised and tenoned, secured either with wood pegs or with bolts. The lower chords of the trusses are single 7-1/2 inch by 14-3/4 inch timbers, some 33 feet in length, two each truss. The joint at the center of the span is a bolted splice with a 4-1/2 inch by 13 inch timber on each side of the main chord members. These splice members are 18 feet in length.

This roof framing system is in fairly good condition but evidence of potential problems exists. Numerous stains on framing members is evidence of roof leakage, although no active rot conditions were detected.[32] Great potential for leakage exists at the gutters and snow rail anchors, and a careful inspection of framing along eaves is important. A possible problem may exist just north of the pavilion, as evidenced by dislocation of the stone cornice, which can only effectively be investigated when the roof is opened and framing exposed.

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31. See Drawing 458/28001, Sheet 10 of 11.

32. See Illustrations 36 and 37.

Some truss members exhibit longitudinal cracking. Analysis is recommended to determine if these are from dryness or loading stresses. Many of the short diagonal members on each side of the trusses are not receiving any loading, but merely resting in their joints. Truss joint failures or dislocations are a possible cause but no obvious visible evidence would indicate this. Long-term shrinkage and seasonal loading adjustments within the trusses may account for the gaps at upper ends of these members and that upper chord members are more than adequate to carry the roof loads. Observation under heavy snow loading will provide some clues.

Evidence of historic features not now in existence can be seen in the attic. Roof sheathing boards to the south of the elevator shaft indicate a possible skylight like the existing one on the opposite side of the elevator shaft. Similarly, sheathing boards at both ends of the pavillion roof indicate there may have been skylights in those locations.

Near the ends of the main roof ridge, sheathing boards have been patched in and no ridge pole exists between two rafters at each location. Beneath these locations are three timbers between the two adjacent trusses and a platform-like arrangement. In a c. 1880 view of the building, chimney-like features can be seen at these locations. Illustration 7 shows the vent and shows them to be masonry. Penetrations through the attic floor are not visible so the chimneys may have only been attic vents.

2. Tower Interior

The principal feature of the tower interior is the spiral stairway.[33] Above the first floor level, a cylindrical space was created within the square tower for the stair. Floor to floor heights vary, but the stair width and tread/riser design remains similar from the first floor

33. See Illustration 14.

to the attic. The method of framing the stair has not been determined. The stair is enclosed by the solid railing on the inside, consisting of vertical tongue and groove boards, with a handrail cap. The curved walls and underside of the stair are plastered. There is also a vertical tongue and groove board wainscot at the outer wall, but no handrail.

Public use of the stair has been prohibited because of the lack of a railing on the exterior side.

At the first floor level, the wall separating the tower and main building reveals evidence of historic details. The double door entrance to the main building interior is a fairly recent installation. The doorway opening was originally arched similar to first floor windows. Hairline cracks in the plaster around the doorway on the tower side of the wall reveal the form of the architrave, which is also similar to that of the first floor windows.

At mid-levels of the tower, windows are detailed both on the exterior and interior in the same way as those of the rest of the building except that the interior window trim conforms to the curvature of the wall. The positions of the windows also conform to all other windows and the spiral stair crosses the openings at various levels.

Above the attic level, the circular stair becomes narrower at the clock floor, where a circular wood wall of vertical tongue and groove boards separates the stairwell from the remaining space within the exterior walls of the square tower. This space between the walls contains the clock mechanism and the drive rods to the clock faces. The exterior brick walls and the ceiling here are plastered. The balcony-like walkway around the open stairwell has a lower ceiling of tongue and groove wood boards radiating from the center point of the tower. Similarly, the raised ceiling over the open stairwell is radiating tongue and groove boards with a wood medallion at the center and wood consoles at the perimeter.

The last flight of the stair, narrower than the main section, continues to the upper floor which contains the flagpole base and an access stair to the roof. Walls of this upper level are plastered but the ceiling is wood.

Except for the concrete loading dock at the first floor, all floors in the tower are wood. Walls on the first floor level were painted in 1977 with light tan latex base paint. Walls, ceilings, and stair rail in the upper sections of the tower were painted either grey or aluminum probably in the 1940s. Early white paint is found beneath these.

3. Ceilings

The original ceilings of first, second, and third floors were plaster and sawn lath on wood furring strips. At first and second floor ceilings, the furring strips are nailed directly to the bottoms of the joists. Furring strips of the third floor ceiling are suspended by wood hangars from the joists, concealing all of the framing above, whereas the main beams were exposed below the first and second floor ceiling planes.

At a later period, pressed metal ceiling panels were installed, probably to solve the problem of deteriorating plaster. The date of this installation has not been determined, but may have been c. 1880-1900, this period being speculative.

The pressed metal panels measure 2 feet by 4 feet, with the decorative patterns pressed to read as 2 foot by 2 foot designs. Panels are secured with round head brads at 6 inches on center around the edges and across the center of each panel.

The decorative pattern is the same on the first and third floor ceiling panels, and there are no borders.[34] Panels with a different pattern were used on the second floor and each bay section has a border.

Ceilings of the third floor and the ceilings, beams, and columns of the second floor are painted aluminum color, probably done in

34. See Illustrations 24 and 25.

the 1940s. The ceilings, beams, and columns of the first floor are painted either white or cream except the lower 4 feet of the columns are tan.

There is no finish ceiling in the basement. The exposed joists, beams, and subflooring are whitewashed, but the columns are done in the aluminum color paint.

Damaged and buckled ceiling panels can be seen along the perimeter of the third floor ceiling and in the second and third floor pavillion areas. Paint build up is beginning to be a problem on the first floor ceiling panels, obscuring the pattern detail.

The backs of the panels are protected by blueing, and although there is evidence of some rusting, it appears to be minor. Most ceiling panels throughout the building are in good condition, except on the third floor along the walls and in the pavillion on the second and third floors. At these locations, roof leakage has caused rusting and sagging, the latter probably due to rotted furring strips.

4. Walls

Interior walls of all three floors are plastered. There are very few paint layers on the walls or window trim. This lack of paint may possibly be attributed to an historically nonheated interior. The walls would have been subjected to less interior-exterior temperature differentials and less air movement may have kept walls cleaner. There is no evidence that the building was heated until the steam lines were installed in 1906.

First floor walls are institutional green with a painted "wainscot" of dark green. The 13 inch high wood base trims are painted the same color as the "wainscot" areas. On second and third floor walls, the existing paint scheme is aluminum with a grey "wainscot" to window sill height. The aluminum and grey paint probably dates from the early

1940s. Underlying these paints were found only one or possibly two layers of a chalky white paint.[35]

First floor walls are generally in good condition. Third floor walls have suffered water damage from roof gutter or snow rail anchor leakage. Large areas of peeling paint and deteriorated plaster along upper sections of the walls will have to be removed, replastered, and repainted. Damage on second floor walls is less severe and more localized. The second and third floor walls of the pavillion are also water damaged. Leakage has occurred along the main building wall and some damage has been caused by wind-blown rain through broken windows.

The brick basement walls were not plastered. The brick was whitewashed or in some areas painted aluminum color in recent times. In the pavillion areas used by the television station (basement and first floor), walls are white. Basement walls below grade level suffer from moisture intrusion which has caused peeling of paint, efflourescence, mortar deterioration, and spalling of the brick.

5. Floors

First, second, and third floors consist of 1 inch by 3-1/4 inch (exposed face) tongue and groove flooring. The material is a very straight, close-grained wood, possibly maple. The reverse side of the flooring is imprinted with the manufacturer's identification: (M. A.?) HOLT, OCONTO, WIS. This existing flooring appears to be a later period application. On the third floor it was applied over building paper beneath which is an earlier tongue and groove flooring of the same width but running in the opposite direction (east-west, whereas the visible flooring runs north-south, parallel to floor joists). The existence of subflooring was not determined. The later flooring was secured with cut nails, thus it may date from the early 1900s or before. The number of

35. See Appendix B-4.

flooring layers was not verified on the first and second floors, but the first floor has 1-1/2 inch thick plank subflooring. The other floors probably have similar construction, 1-1/2 inch plank subflooring and two layers of I inch tongue and groove flooring. Flooring in the pavillion may be the original. The flooring has been maintained on the first floor but the second and third floors lack varnish and wax and are dirty.

The third floor has damaged sections of flooring caused by water from roof leakage. Along the west side of the building and at the elevator shaft are six areas where the flooring is badly buckled. There are three similar areas in the third floor pavillion. There are water stains on the flooring at both ends of the second floor pavillion.[36]

Attic flooring consists only of random width 3/4 inch thick tongue and groove boards. Their general condition is good but some localized areas are weak. This flooring is applied with cut nails perpendicular to the floor joists. There is no subflooring and the boards span 19 inches (5 inch by 10 inch joists at 24 inches on center). Thus this flooring material will not support heavy loads.

The basement floor is concrete, probably applied over the original paving, which is assumed to have been brick.

6. Windows

The exterior masonry opening width at basement windows is 4 feet 1/4 inches wide, the top being 1 foot 3 inches down from the water table. The height of the opening is in the order of 2 feet 9 inches. The concrete window well curbs are 4 feet 8 inches to 4 feet 9 inches long and 8 inches wide. The windows are covered with a heavy wire mesh.

The interior openings are brick with an arched top. The sides are splayed, the bottom sloped down and inward. Window frames

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36. See Illustration 30.

and sash are wood, casement type, opening inward. The two sash have 2 over 2 lights each. The bottom portions of the wood window frames and sash are deteriorating from excessive water intrusion due to the position of the concrete curbs.

The exterior masonry opening of first floor windows is 4 feet 1-1/4 inches wide and approximately 8 feet 5 inches high. The round-arched upper section consists of a corbeled design in three pieces of red sandstone. The intrados of the keystone and two side pieces are cut to the semi-circular form. The extrados is cut to reflect the rusticated quoin motif of the brickwork forming the jamb portions of the architrave surrounding the opening. Brick panels below the stone sills are inset.[37]

Windows are wood frame and sash, double hung, each 8 light sash being 4 lights wide and 2 lights high. A semi-circular-fixed fan light sash above completes the design.

Second and third floor windows are rectangular. Second floor window openings are defined by a slightly projecting brick and stone architrave. The red sandstone lintel is a triangular pediment form. The projecting brick jamb sections are plain.

The third floor window openings have no projecting architrave and the flat red sandstone lintels are set flush to the brick wall face. Only the stone sill projects.

Second and third floor windows are wood frame and sash. Although second floor windows are greater in height, each double hung unit of both second and third floor windows are 12 lights each, 4 across, 3 vertically.

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37. See Illustration 20.

The interior window and opening design is similar on all three floors. The wall thickness of the building permitted the window openings on the interior to be developed to create a bay effect. The splayed sides are plastered except below the window stool level which is of vertical tongue and groove boards forming a wainscotting. Plain-faced boards alternate with boards beaded on both edges. They are not of consistent widths, varying from 3-3/4 inches to 5-1/2 inches below the windows, and 6 inches to 7 inches on the splays. The boards are 1/2 inch to 3/4 inch thick, nailed at the floor and window stool only, the face being 1 inch out from the brick wall behind. These splayed bay openings are trimmed with a plain wood architrave, having a pediment design reflecting the exterior pediments of the second floor windows.

Windows are in fairly good condition, but suffer from lack of maintenance. Exterior paint is in poor condition. Cracked and peeling paint has allowed water intrusion, but at the same time the wood is extremely dry from air and sun exposure. Some stiles, rails, and muntins are broken or marred. Also some ropes for the sash balance weights are broken. Frame and sash repairs should be accomplished fairly easily as the wood sash stops are removable, secured with wood screws having no point. Sash frame joints are mortise and tenon and pegged.

The window glass for many years was coated on the inside with greenhouse-type paint, and traces still remain. The painting of windows was probably to reduce impacts by light on wood gun stocks.

Most broken glass was replaced in 1977, but modern glass was used which did not match the older glass. The new repairs had failed by 1978. The putty or glazing compound did not bond to the wood, probably due to dry wood absorbing excessive oil out of the putty, preventing curing.

7. <u>Doors</u>

Doors between the main building and tower are metal clad. These are not original. Pavillion interior doors have been changed or modified.

D. Building Systems

1. General

A detailed analysis of all building systems was prepared by R. G. Vanderweil Engineers, Inc., through Stull Associates to supplement the draft historic structure report and to allow basic system decisions to be made (see Appendix B-1 and B-2).

2. Water Supply, Sanitation, and Storm

Water lines were installed at the southwest end of the square in 1852,[38] but it is not known if the Main Arsenal had water supply or sanitary lines this early. Utilities are shown on 1864[39] and 1877[40] maps but again the specifics are difficult to determine. Certainly the 1885 to 1900 period saw utility additions and improvements,[41] and Building 13 definitely had water in 1897, the date of installation of a hydraulic elevator.[42]

Both sanitary and storm sewers discharge to a combined system outside the building. The storm sewers appear to be at least partially blocked. See Appendix B-1 for greater detail.

3. Environmental Controls

The building was probably not heated historically until the present steam supply was installed. This installation may be as early as c. 1906, when a central steam plant was built at the Armory.[43] The college now operates the central plant and supplies the steam to the Arsenal and Commanding Officer's House.

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38. Albright, pp. 39, 40.

39. Ibid., Map 8, p. 51.

40. Ibid., Map 10, p. 65.

41. Ibid., pp. 70, 74.

42. Ibid., p. 98.

43. Ibid., p. 78.

A 4 inch steam main enters Building 13 at the southeast corner of the basement, runs along the east wall, exits at the north corner, and apparently continues to Buildings 1, 10, 2, and 3. The basement is heated by pipe radiators which are uncontrolled and non-uniform heating occurs. Industrial fan coil units on the first and second floors are fed by risers near each end of the building.

4. Electrical System

Although an electric light plant was built at the Armory about 1906,[44] the Main Arsenal may not have been supplied with power at this time. The system appears to be a later period but a pre-contemporary conduit-type system. The building service is 550V, three wire, three phase Delta. The elevator runs directly off the 550V service. The service is stepped down to 115V, three wire, three phase Delta for distribution through the rest of the building.

Basement lighting is mostly incandescent bare bulb with some flourescent tube fixtures. The north exhibit area on the first floor is lighted both by flourescent tube and spot fixtures, the south exhibit area with spots. Emergency light units are mounted at both ends of the first floor and at the elevator.

Second floor lighting branches are run at the center of each bay from a feeder at the ceiling along the northeast wall. Incandescent bare bulb fixtures are laid out alternating with two then three each bay. Third floor lighting is similar except some fixtures have reflectors. Attic lighting is also incandescent and tower and pavillion lighting is similar to that of the second and third floors. The system has very few convenience outlets.

Circuit breaker panels are located on each floor to the southeast of the doorway to the tower. An unprotected oil transformer is located in the northeast corner of the basement.

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44. Albright, p. 78.

System conductors are in very poor condition. The rubber and fabric wire insulation is very brittle and breaks when disturbed.

5. Security System

The Arsenal is protected by a fairly new intrusion detection system, monitored by a local security firm. A security survey was conducted August 19, 1978, by John E. Hunter, Staff Curator/Physical Security Coordinator, Midwest Regional Office, National Park Service. Reports are available to authorized personnel through the regional and park offices.

6. Fire Protection

The building has a dry pipe water sprinkler system dating from 1912-13.[45] The system was not maintained from 1964 to 1977 and not regularly tested. In 1977 the system was tested and made operational, except for one riser serving the attic, tower, and part of the pavillion.

The system covers all of the building including the basement, attic, and tower. There are three risers, two at the east wall near the center of the building, and one at the west wall. From feeder lines along the center of the building, distribution is each way at each building bay, with seven heads each bay. Each floor of the pavillion has one distribution line with seven heads.

The water supply main is 8 inch and the three-control valves are located in a basement room near the elevator.

7. Fire Egress

First floor egress is through the tower doors, two windows at either end of the building, and one window in the pavillion. Only the

45. Albright, p. 98.

tower doors are panic operable. The window exits are unmodified lower sash of the double hung window. Second floor and third floor egress is the same except there is no exit through the pavillion.

The second and third floor window exits, empty onto cast iron fire escape landings and ladders which empty onto a first floor exit landing, with stairs to grade. The date of installation of these fire escapes in unknown, but they were in place in 1968. The escapes are rusted and paint is peeling.

Basement egress is via stairs in the pavillion and at the front of the building and via two window exits on the west side of the building. Exit doors and windows are not panic operable.

8. Elevator

During the first four decades of the building's life, vertical handling of the guns was probably accomplished with a hoist system or lift platform in the tower. The first elevator was hydraulic (water-powered), installed in 1897.[46] The existing elevator was installed in 1940 or 1941.[47] On the inside of the brick elevator shaft just below the second floor opening is a date stencil applied in black on the aluminum paint - Dec. 25, 1941. (This was covered in 1977 when the interior of the elevator shaft was repainted.)

This elevator is a semi-open cage freight elevator, with wood flooring and wood lining on the sides and back.[48] The cage has no door; the top consists of the hoist mechanism and an open steel grating. Doors at each floor level opening are double leaf, vertical acting, counter-weighted, and manually operated. The elevator control system is

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46. Albright, p. 98.

47. Ibid., p. 98.

48. See Illustration 32.

not automatic, but consists of switch buttons for "up," "down," and a signal bell. The machine room at the top of the shaft is entered from the attic. This elevator was manufactured by the Bay State Elevator Co., of Springfield, Massachusetts.

The elevator is operable but unsafe. Public use cannot be permitted.

D. Recommendations

1. General

The following recommendations for Building 13 are based on a restoration date of 1968 and proposed adaptive use of the building interior. Conditions as they exist today generally represent the building finishes and configuration of 1968. The recommendations for the building exterior can be characterized as preservation/stabilization, designed to produce a weathertight building envelope, with no alteration of existing finishes or appearance.

The interior of the Arsenal is proposed to be adaptively used as both museum and administrative headquarters. Modifications for functional use are anticipated which may impact interior historic fabric, but the design philosophy will be to minimize these impacts. The recommendations for the building interior are for preservation of interior finish and do not address specific adaptive use needs.

2. Exterior

a. Masonry Work and Trim

Both brickwork and stonework should be repointed with lime mortar (see Appendix B-4 for formulations). Partial repoint is expected since significant portions of the existing pointing appear sound, particular attention is required when deteriorated flashings have allowed erosion of the mortar. Procedures for repointing should be controlled in order to minimize mortar staining. Cleanup should be with water only, no acid. Since the existing sandblasted brick is wearing well, sealants should not be considered at this time.

Salts to melt ice should be curtailed at the Arsenal entrance, to reduce damage due to efflorescence, particularly around the tower entrances. Rare earth poltices can be used to remove some of the worst salts and pollutants.

b. Roofing

(1) Slate Roof

An inspection by a slate roofing contractor indicated that repair and replacement of damaged slate and replacement of previous inadequate slate repairs should result in a sound roof. When exposed, sheathing and roof structure should be inspected for deterioration and repaired if necessary. Particular attention should be paid to the truss ends since water stains indicate leakage at some earlier time. The roof should be inspected on a continuing basis after the initial repairs are completed.

(2) Tower Roof

The existing, leaking, copper tower roofing should be replaced with new copper roofing. The roofing system should be detailed to ensure positive drainage of the tower roof. When the roof is opened inspect sheathing and structural members for deterioration and replace if necessary.

c. Flashing, Gutters, and Down Conductors

(1) Ridge Cap

Repair and solder damaged cap where possible. Replace with new copper where repair is not possible.

(2) Eave Flashing, Valleys, and Gutter

Replace with new copper. Inspect substrate for deterioration and replace if necessary.

(3) Down Conductors

Replace with new copper down conductors. Use design and anchors similar to existing.

d. Snowrail

Anchorages should be evaluated relative to structural adequacy and flashings. Replace missing section with rail made of treated or decay-resistant wood, configuration to match existing. Replace deteriorated rail with new snowrail, anchors, and flashing where the wood snowrail has deteriorated and flashings have leaked previously. Inspect truss ends, rafters, and sheathing for possible deterioration, repair where necessary. Paint snowrail.

e. Tower Safety Rail

Repair and paint existing railing. Replace deteriorated wood members with treated members. Low pressure sandblast metal elements, prime, and paint.

f. Wood Trim

Repair and paint wood trim, such as cornice molding.

g. Windows

Repair existing sash, frames, and sills. Replace deteriorated members with members of matching cross section. Reglaze with glass matching existing glass, use of greenhouse glass or glass meeting Fed. Spec. DD-G-451d, Class 1, Quantity q4 is anticipated. Replace missing or damaged sash cords and sash locks. Basic procedure would be as follows:

(1) Remove loose and peeling paint with scrapers and sandpaper.
(2) Replace deteriorated wood elements with new of wood type and cross section to match existing. Make all sash operable and provide for fixed or operable sash as desired.
(3) Apply linseed oil and turpentine mixture to bare wood.
(4) Scrape and sand.
(5) Apply second coat of linseed oil and turpentine mixture.
(6) Back prime.
(7) Install replacement glass, putty glazing and apply wood filler, sand.

(8) Prime with oil base primer.

(9) Date work.

(10) Apply finish coats.

h. Clock Faces and Mechanism

The clock faces should be restored using a combination of preservation and replacement of deteriorated wood members. Removal of the faces from the building and working on them in a shop would be the anticipated method of repair. It is recommended that a craftsman skilled in woodworking and working with gold be contracted with to do the restoration or have a NPS conservator perform the work. The clock mechanism should be repaired.

i. Concrete Window Curbs

Replace with a well which provides adequate drainage and clearance from the bottom of the basement window sills.

j. Tower Bell

Clean and provide protective treatment for bell. Clean, repair, and treat support frame and striker linkage housing. Integrate support curbs with roof repair to ensure roof remains watertight.

k. Lightning Protection System

Test and maintain system in operable condition using replacement elements similar to existing design.

l. Exterior Lighting

Replace globes on existing tower fixtures. Provide exterior security lighting at points of possible entry, mounting fixtures as inconspicuously as possible.

m. Flagpole

Preserve existing flagpole unless a management decision alters the restoration date.

n. Intrusions

Remove post-1968 appurtances such as window air conditioning units.

3. Interior

a. Plaster

Repair and replace deteriorated ceiling and wall plaster throughout the building, including the tower. Repaint repaired and existing surfaces.

b. Millwork and Trim

Repair and refinish existing millwork and trim throughout the building.

c. Metal Ceilings

Preserve pressed metal ceiling panels. Repair or replace panels and wood furring where necessary. Remove existing paint leaving panels in place. The glass peening method is recommended. Provide sealed portable enclosure for this work. Refinish panels: metal primer is recommended, with the finish paint applied by brush (see Section VIII, Building Finishes).

d. Floors

(1) Attic Flooring

Repair where necessary. Vacuum thoroughly and apply wood conditioner.

(2) First, Second, and Third Floors

Repair damaged areas on third floor and second floor pavillion. Clean and varnish. Maintain with protective wax.

(3) Basement

No work other than maintenance.

e. Modern Partitions

Retain or remove modern stud and dry wall partitions as functional needs dictate. Minimize damage to historic materials caused by new partition anchorage.

4. Building Systems

a. General

As a supplement to Robert Carper's original draft reports, Stull Associates prepared a report entitled "Building Systems Analysis and Recommendations," which dealt with the Arsenal building systems. Decisions, based on these reports, were made by park and region March 20, 1980. Recommendations which follow are based on these decisions; for more detail on options evaluated and the exact configuration of the proposed systems refer to the report summaries in the appendix or the actual Stull reports.

b. Water Supply, Sanitation, and Storm

The park should negotiate continued water service through the Springfield Technical Community College. This will provide a safer, more redundent supply system at less cost and less disruption of below-grade cultural resources.

The storm drains fed by the building down conductors should be cleaned and system performance monitored to determine if drainage was improved. Should new drains be required consideration should be given to tying the basement window wells into a new system. The combined sanitary/storm sewer system may require change in the future.

c. Environmental Controls

Evaluation of several options for space conditioning the Arsenal, as well as particular systems, resulted in a decision to provide a new gas-fired boiler system for both Building 13 and Building 1, which will replace the antiquated steam service provided from the college. Separate metering will allow leasing of Building 1 in accordance with policy. The proposed location for the flue required will be visible to the public from only limited locations within the historic site.

The proposed use of the Arsenal as a museum will require humidity and thermal controls to protect collection artifacts. The exact configuration of the systems will be assessed in later preliminary design phases for the building interiors.

d. Gas Service

Gas service will be required to serve the new boiler systems. The gas service is available from State Street, and must cross property to be donated to the National Park Service by the Commonwealth of Massachusetts.

e. Electrical Service

The antiquated service at an atypical voltage must be replaced to provide adequate capacity to service new loads generated by the proposed uses.

Internal distribution systems must be replaced and modified to provide for the proposed uses. The exact configuration will depend upon final space allocations.

f. Elevator

The existing elevator cab should be replaced by a new contemporary cab and the shaft modified to meet code, safety, and equipment requirements.

g. Security System

John Hunter, Midwest Regional Office, made a survey of the existing security system in August 1978 and made recommendations at that time. This report should be consulted for initial information. Continued involvement of a security consultant should be maintained as building configurations change to accommodate the proposed uses.

h. Fire Detection and Suppression

The Arsenal's fire detection should be upgraded now and modified as interior alterations are made.

The existing dry-pipe fire suppression system should be retained. Supplementary systems, perhaps Halon, may be desired in special functional areas, e.g., document storage. Retention of the existing system would require storage and display systems to provide protection of artifacts from water damage while maintaining fire suppression capability. Final suppression decisions will be made when final building use and space allocations are determined during preliminary design for the adaptive use of the structure.

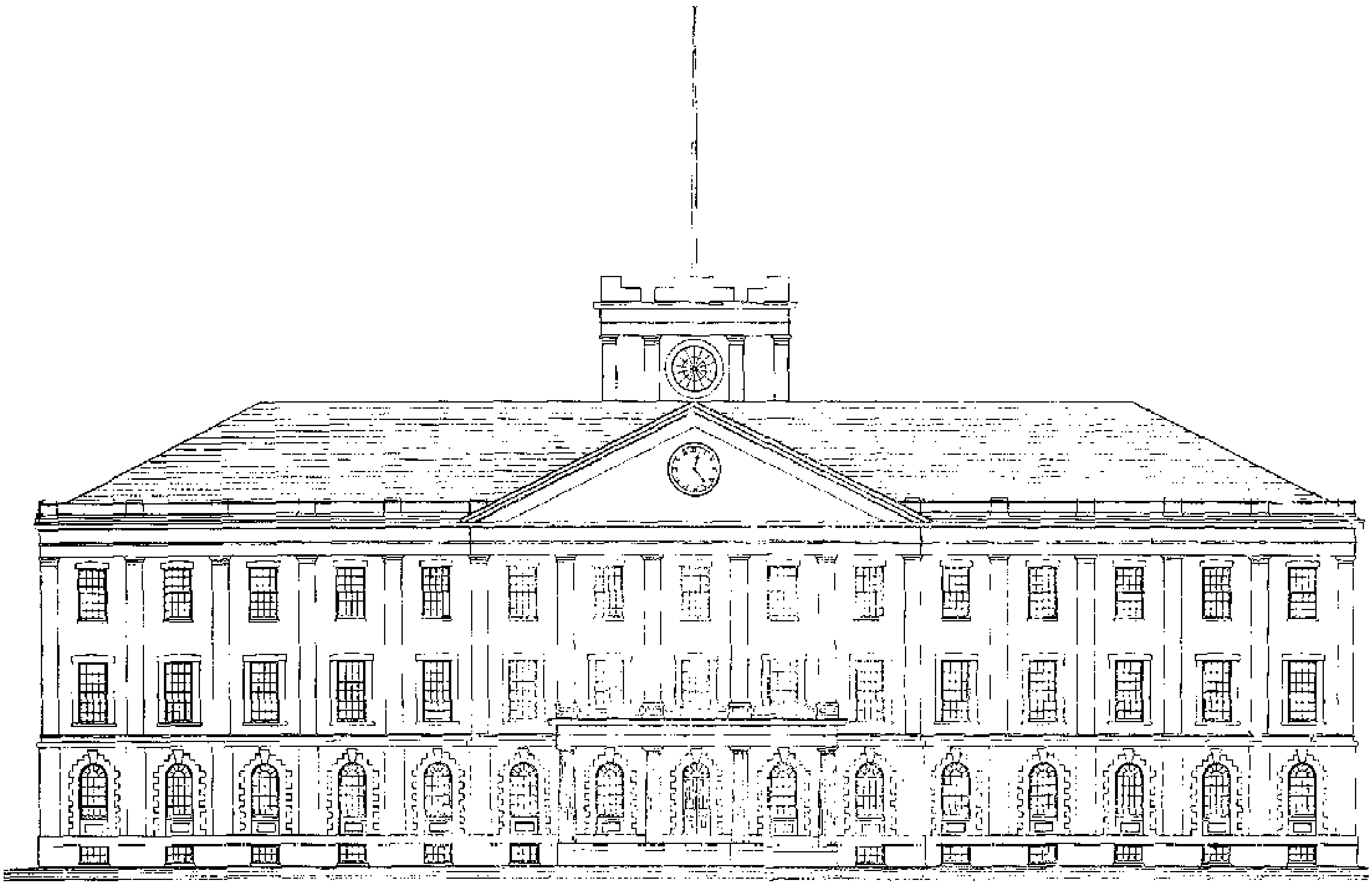


Illustration 3

N.D. Arsenal, View from West, Note One-Story Doric Portico, apparently not constructed N.D.

U. S. Armory, Installation Facilities Office, NPS Park Files

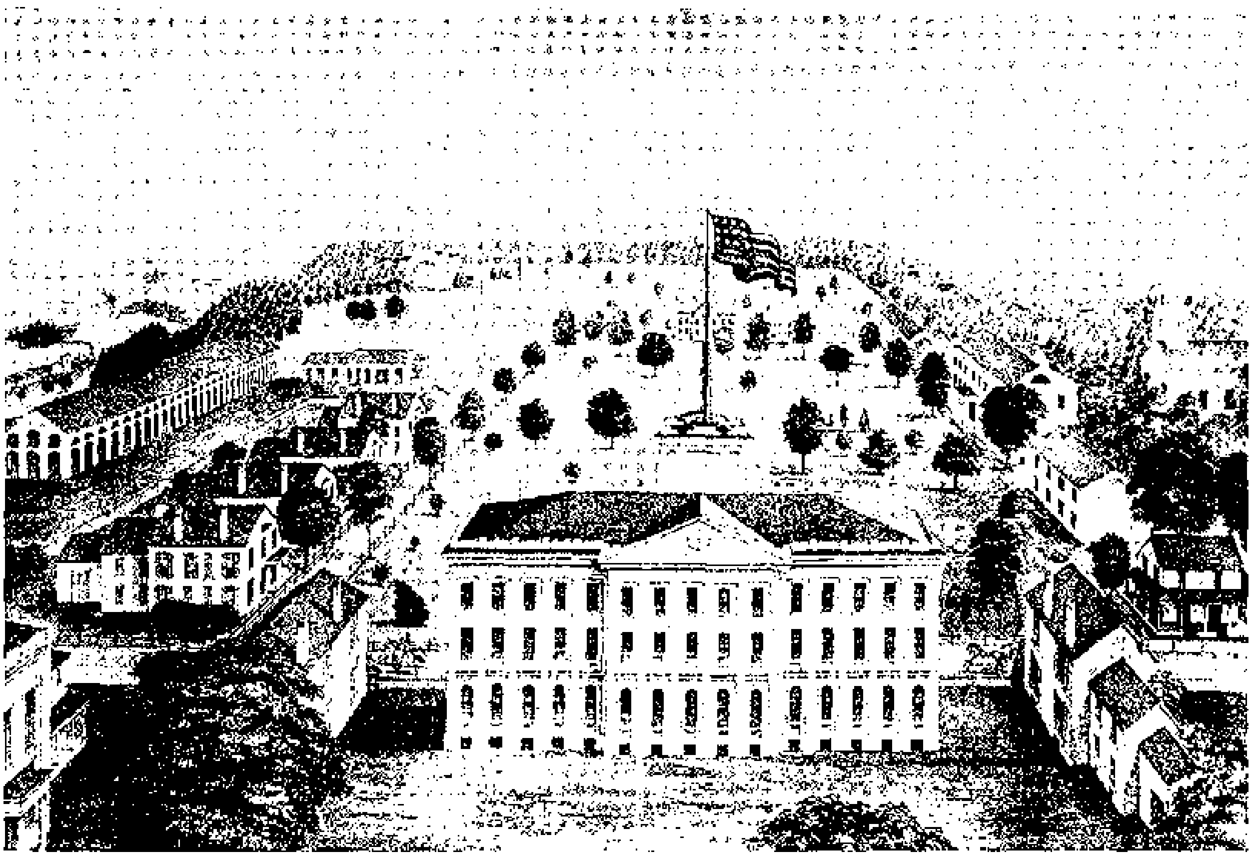


Illustration 4

1860 Armory Square, View from West **1860**

Springfield City Library Collection, NPS Park Files

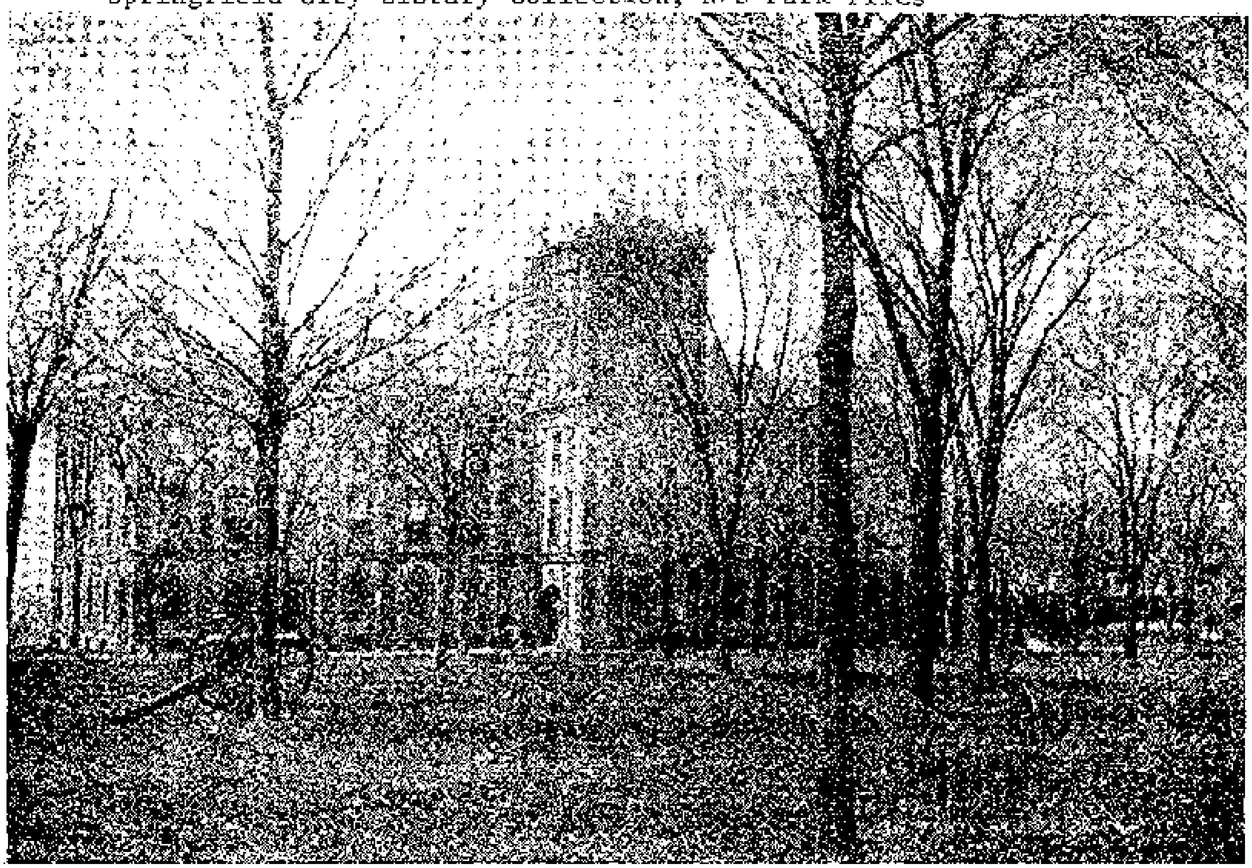
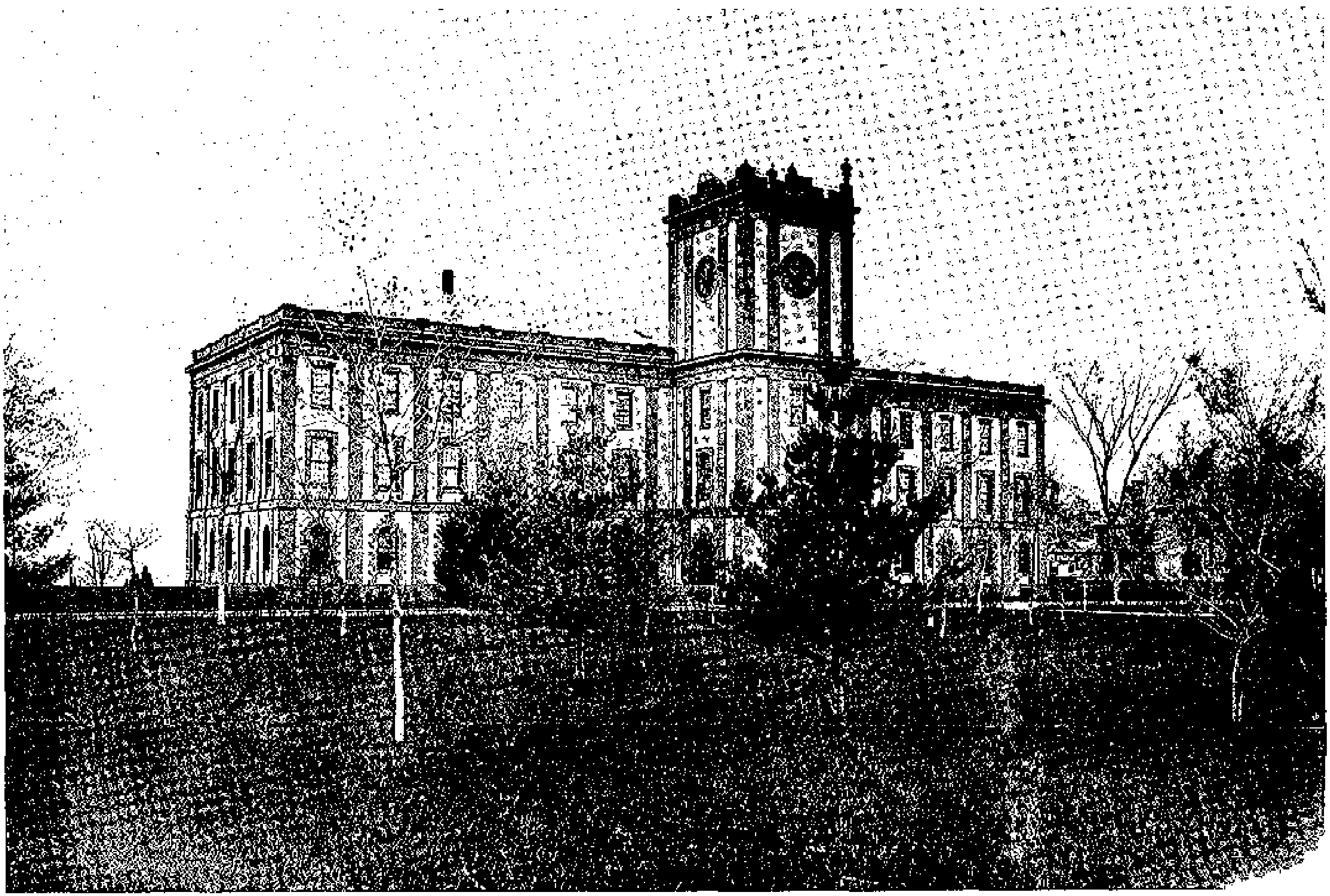


Illustration 5

1891 Arsenal, View from Southeast **1891**

Picturesque Hampden, Warner, Charles F., 1891



c. 1880 -1882

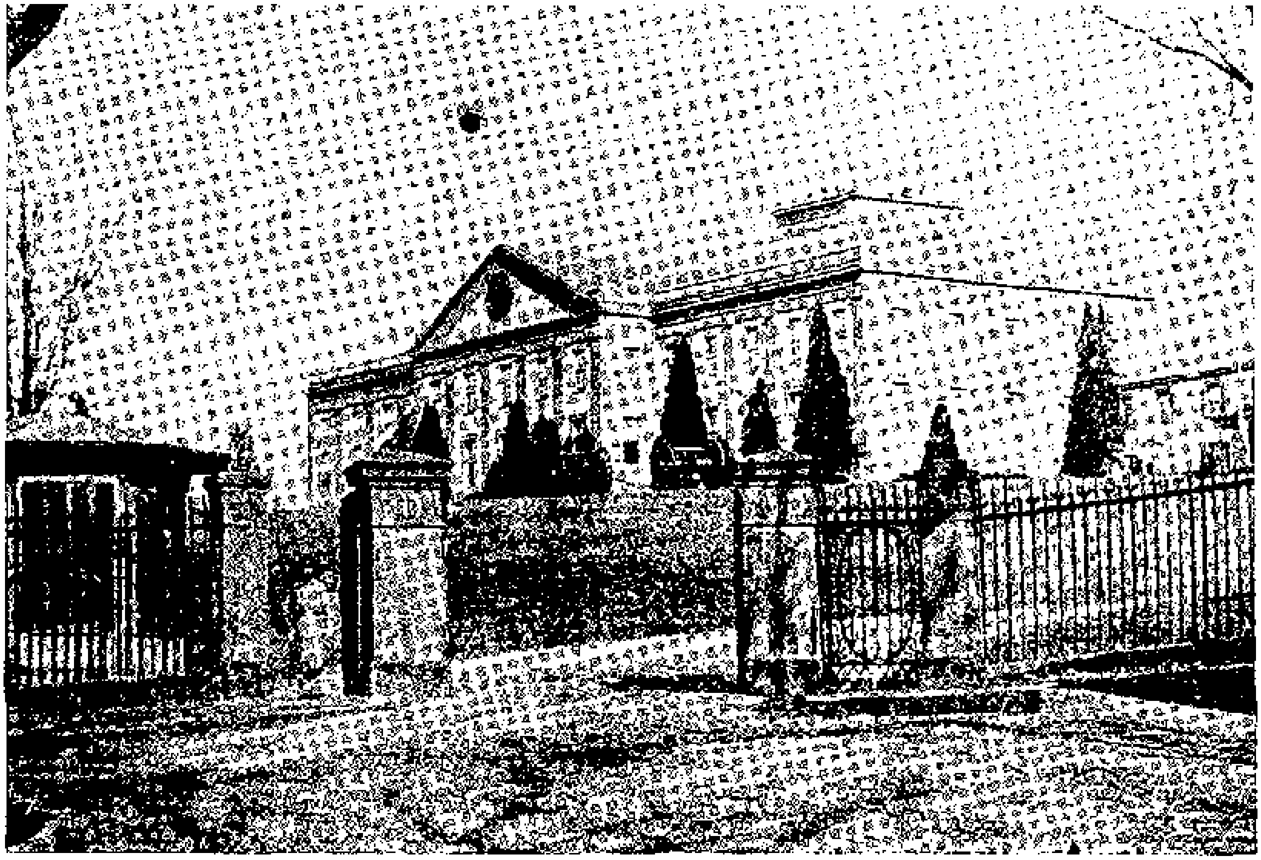
Illustration 6
Arsenal, View from Southeast
Springfield City Library Collection, NPS Park Files

c.1880 -1882

c. 1880 -1882

Illustration 7
Arsenal, View from Northwest
Springfield City Library Collection, NPS Park Files

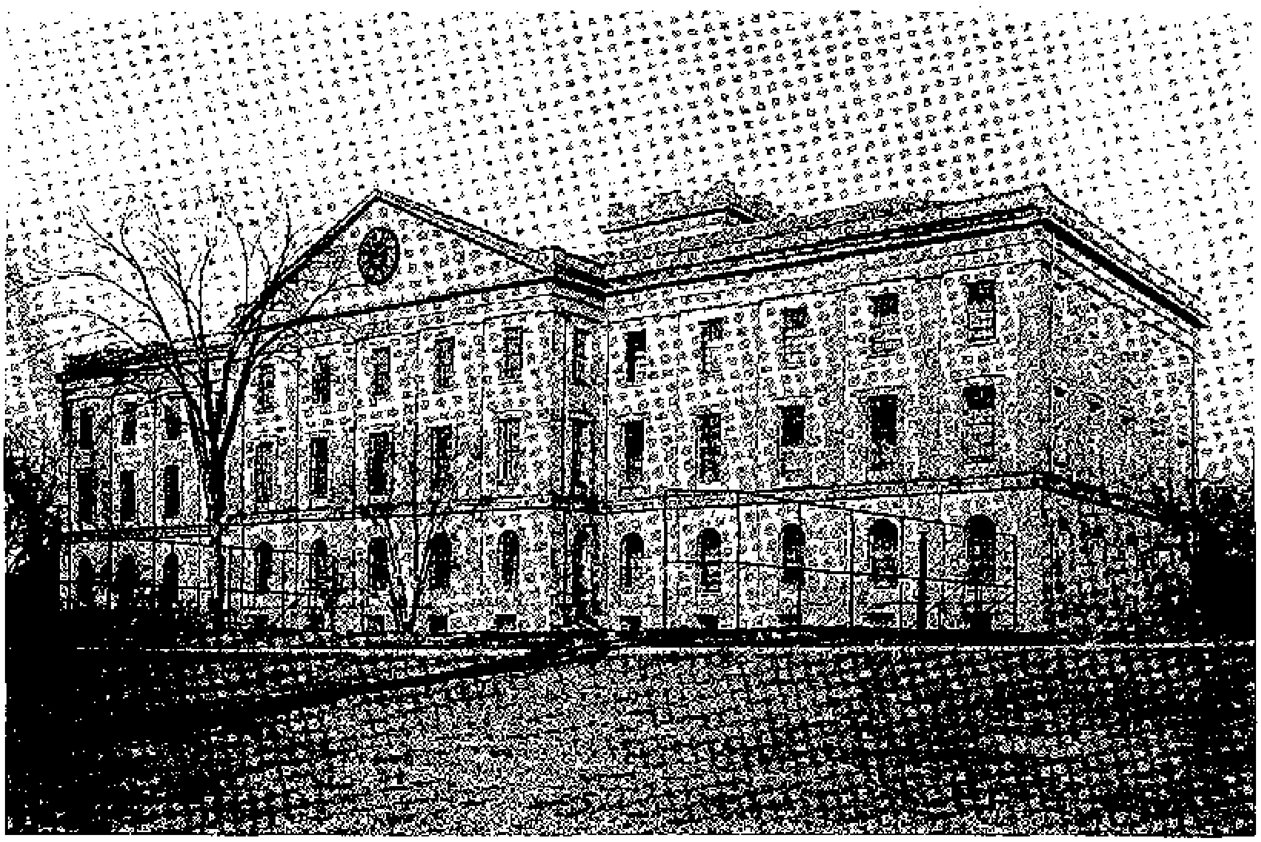
c. 1880 -1882



c. 1880 - 1937

Illustration 8
Arsenal, View from Southwest
Springfield City Library Collection, NPS Park Files

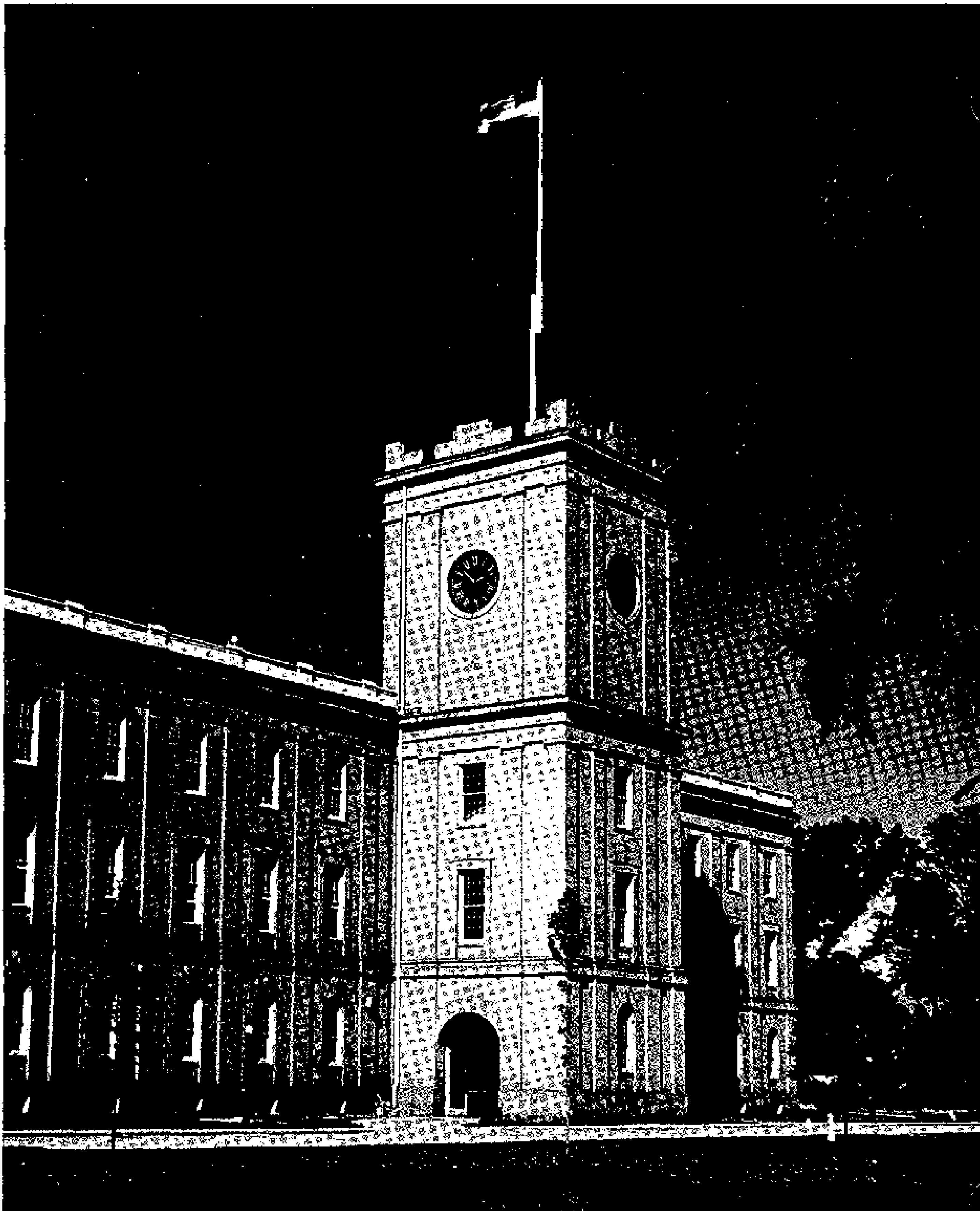
c. 1880 - 1937



1932 1937

Illustration 9
Arsenal, View from Southwest
Springfield City Library Collection, NPS Park Files

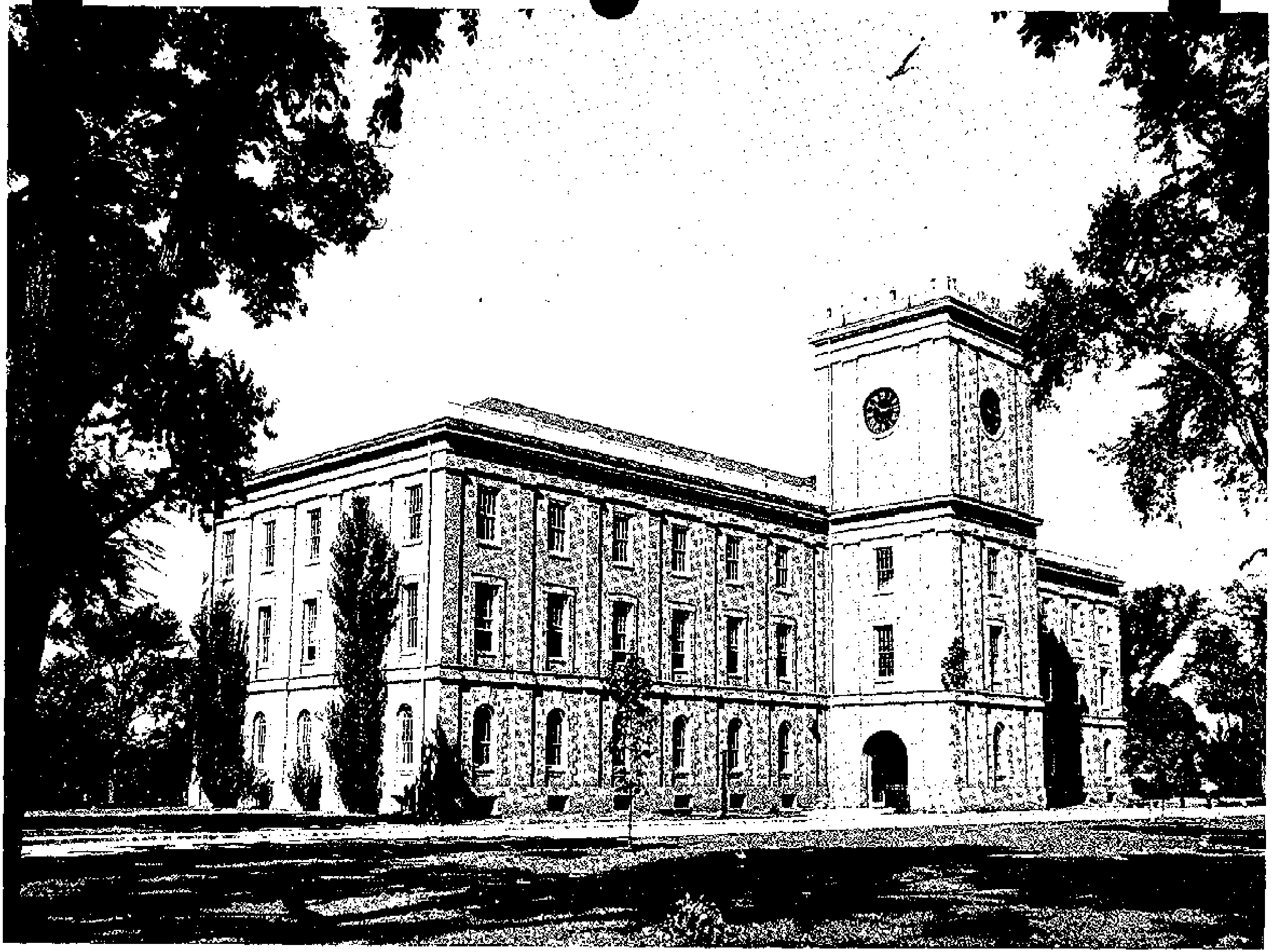
1932 1937



c.1937 -1941

Illustration 10
Arsenal, View from Southeast, Note Full Height Tower Entrance
NPS Park Files

c.1937 -1941



c.1937 -1941 Illustration 11
Arsenal, View from Southeast
NPS Evaluation Report, 1967

c.1937 -1941

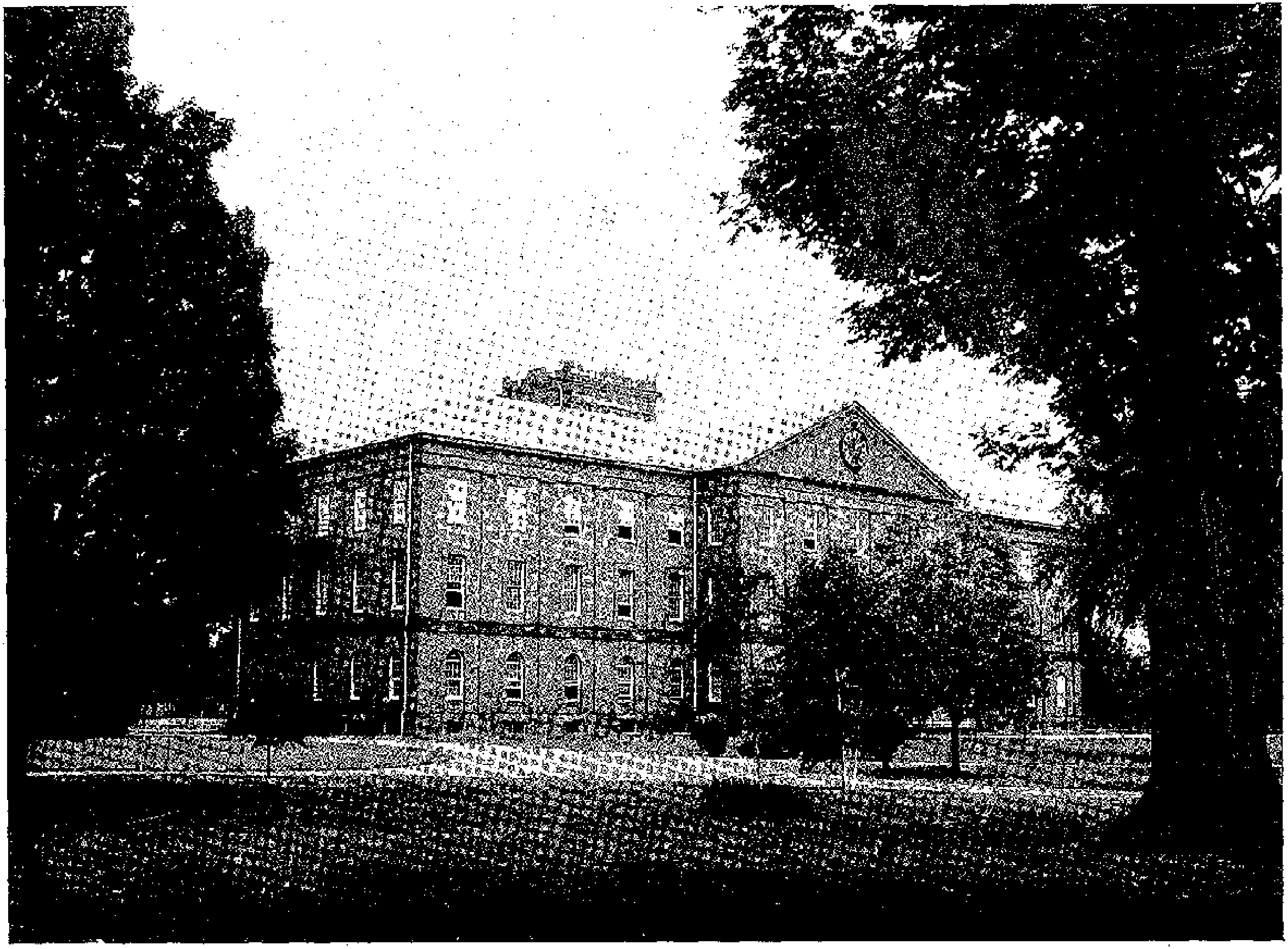
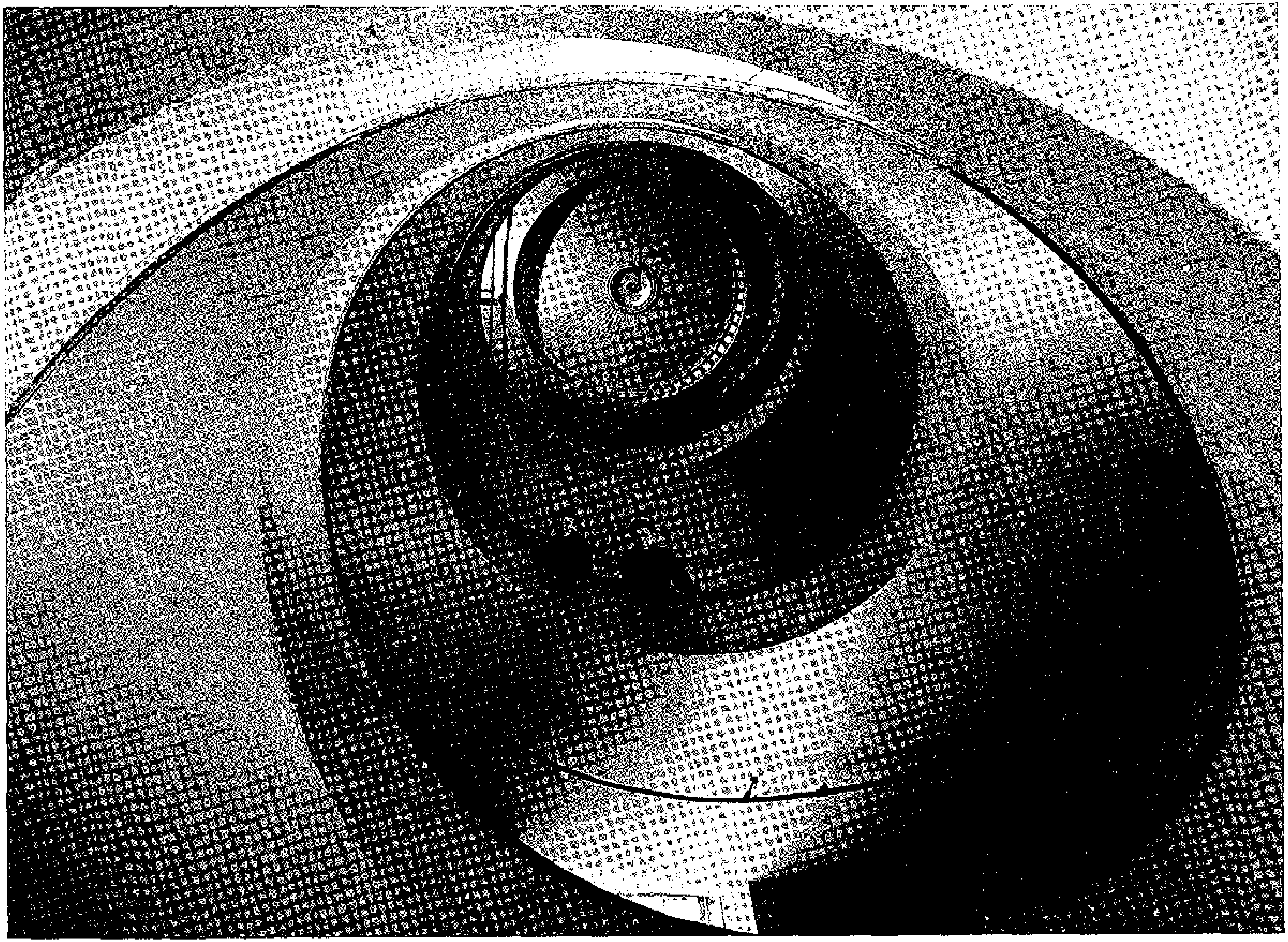


Illustration 12
Arsenal, View from Northwest
NPS Evaluation Report, 1967

1967 1967

1937+ Illustration 13
Arsenal, View from West
War Department Negative No. 6813-SA, NPS Park Files



1944

Illustration 14
Arsenal Tower, View Up Staircase
War Department Negative No. 3685-SA, March 31, 1944, NPS Evaluation Report, 1967

1944

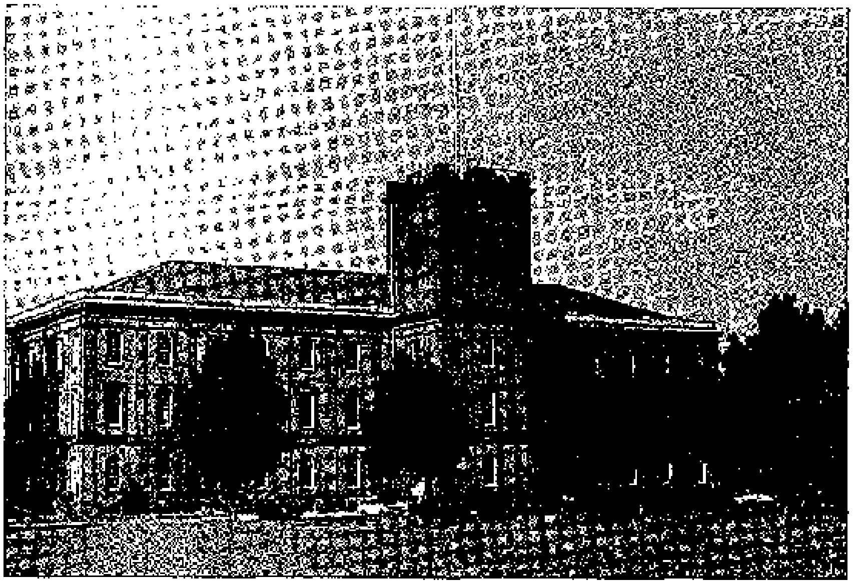


Illustration 15
Arsenal
View from East

1976

NPS Photo, DSC

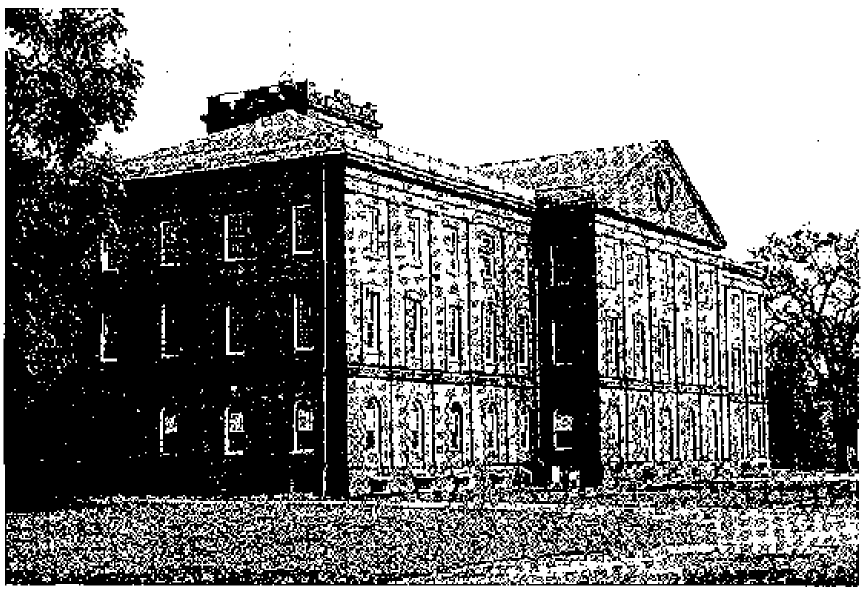


Illustration 16
Arsenal
View from Northwest

1977

NPS Photo, DSC

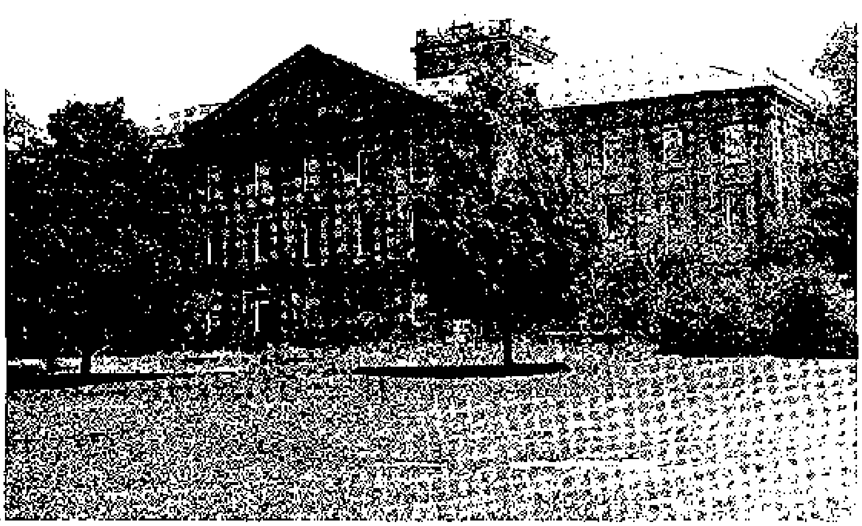


Illustration 17
Arsenal
View from West

1976

NPS Photo, DSC

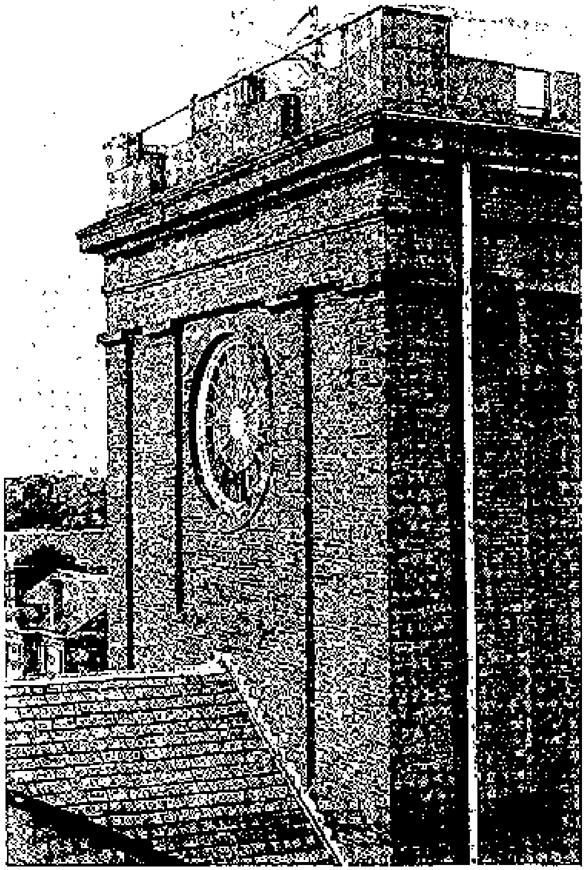


Illustration 18 **1977**
Arsenal
Tower from Southeast

NPS Photo, DSC

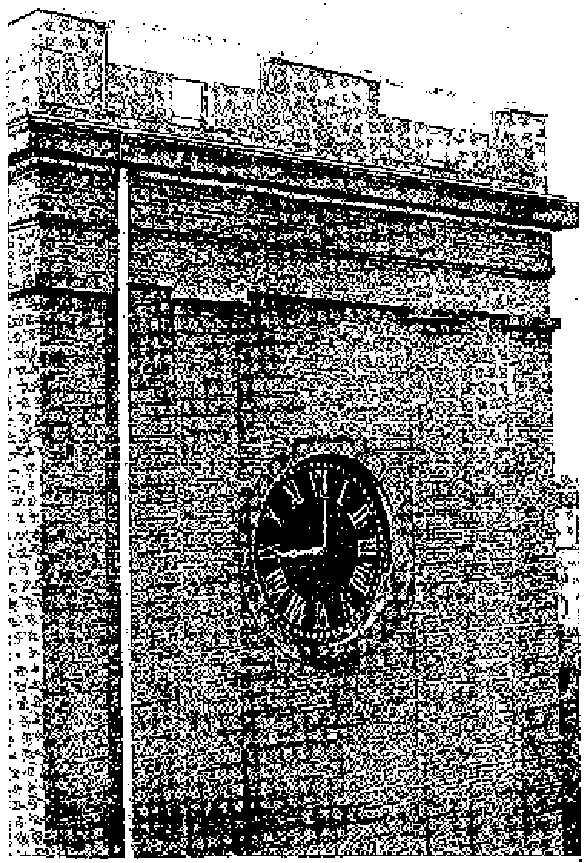


Illustration 19 **1977**
Arsenal
Tower from South
South Elevation

NFS Photo, DSC

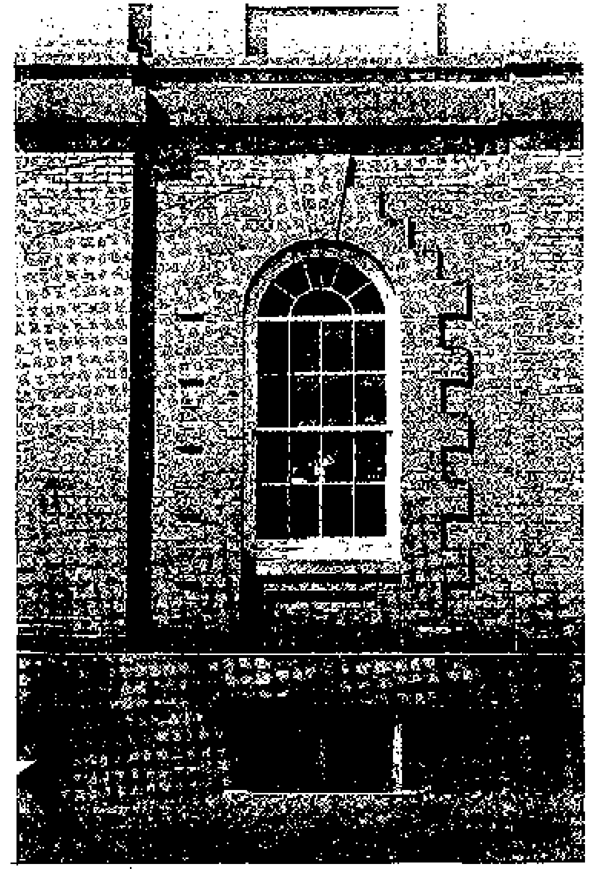


Illustration 20 **1976**
Arsenal
First Floor Window (Typical)

NPS Photo, DSC

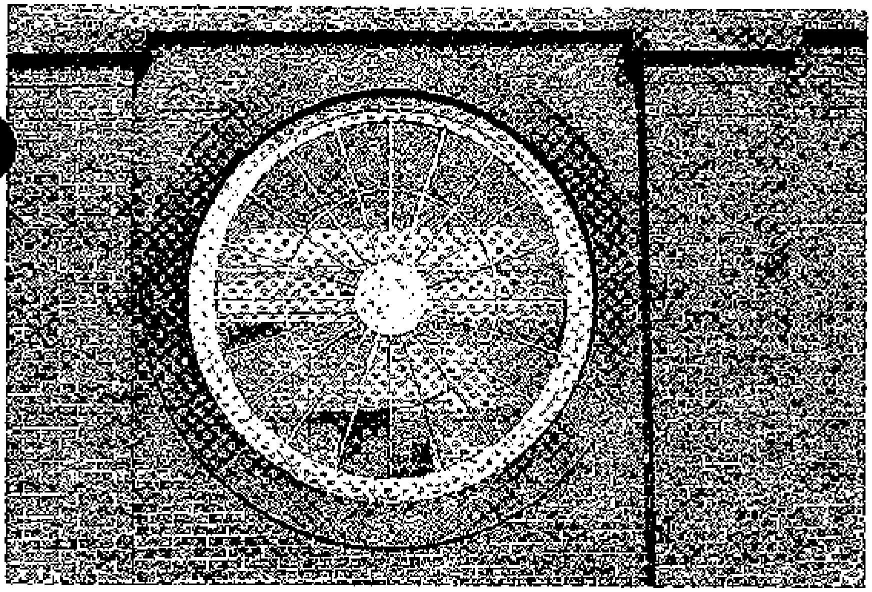


Illustration 21
Arsenal
Circular Tower Window
Note Wood Deterioration

NPS Photo, DSC

1977

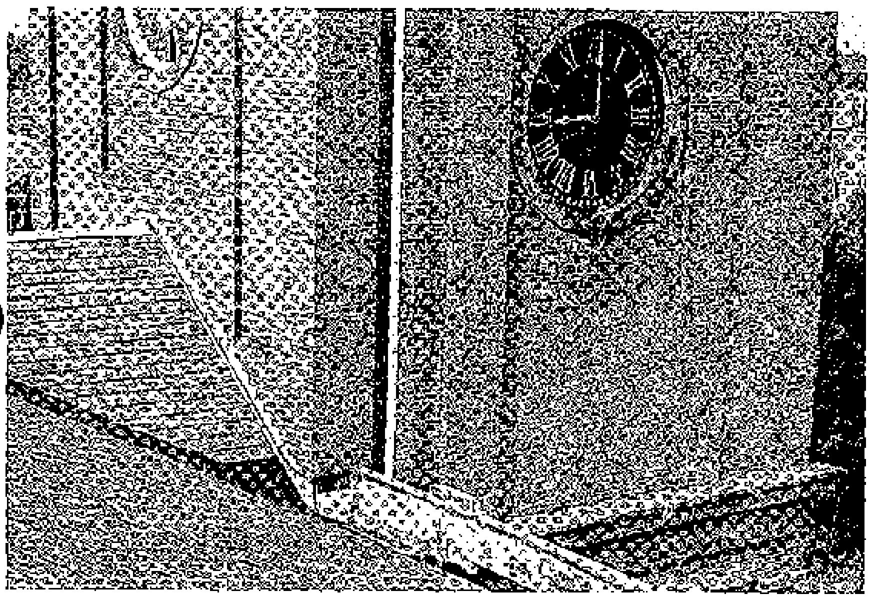


Illustration 22
Arsenal, Tower
View from South

NPS Photo, DSC

1977

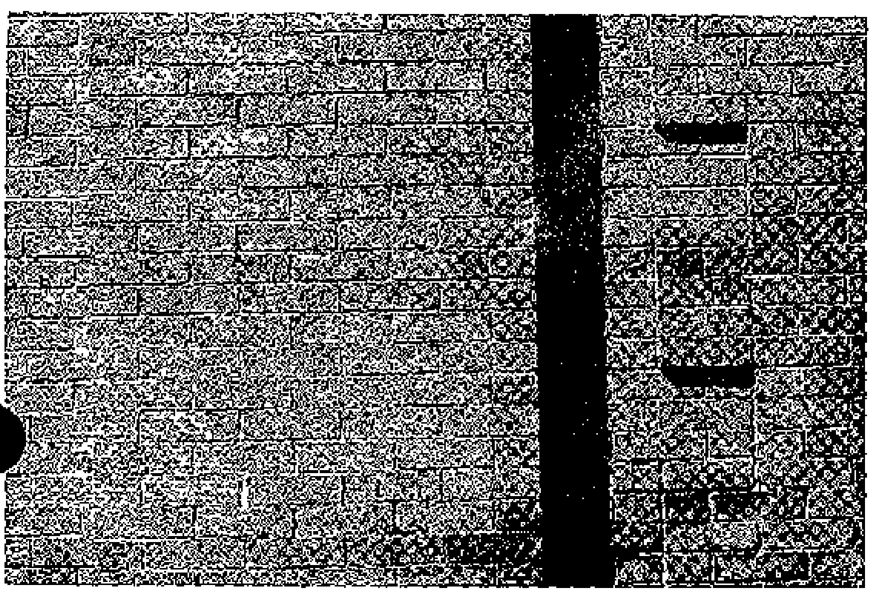


Illustration 23
Arsenal, Tower
East Side
Sandblasted Brick Surface

NPS Photo, DSC

1976

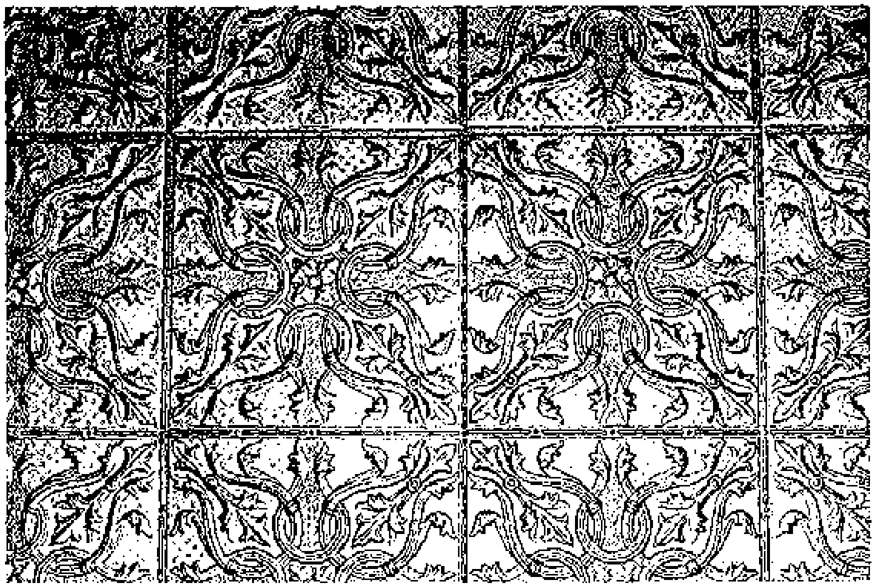


Illustration 24
Arsenal
Third Floor
Pressed Metal Ceiling

NPS Photo, DSC

1976

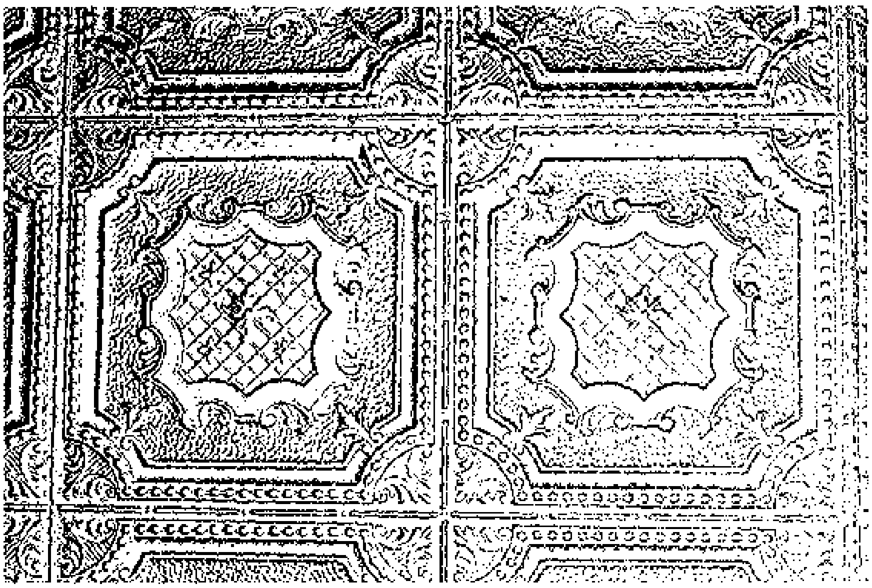


Illustration 25
Arsenal
Second Floor
Pressed Metal Ceiling

NPS Photo, DSC

1976

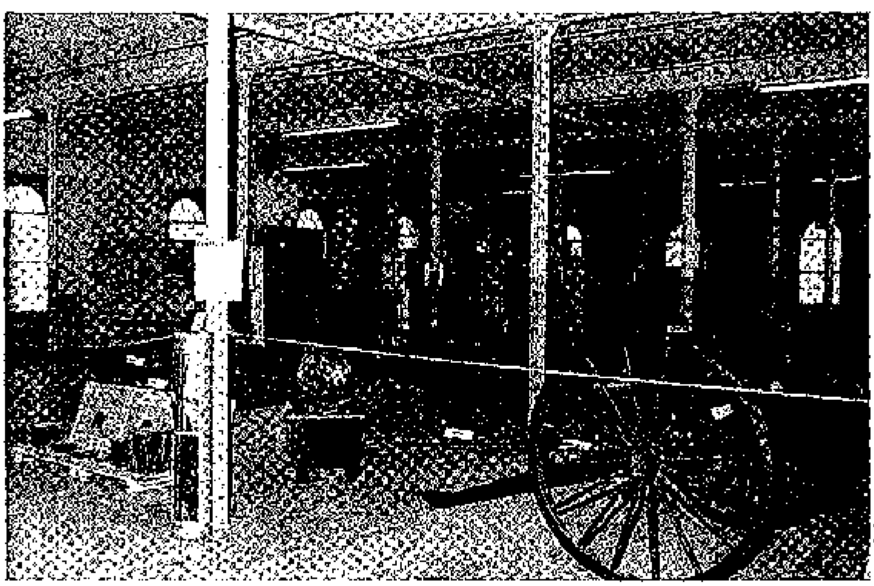


Illustration 26
Arsenal
First Floor

NPS Photo, DSC

1982

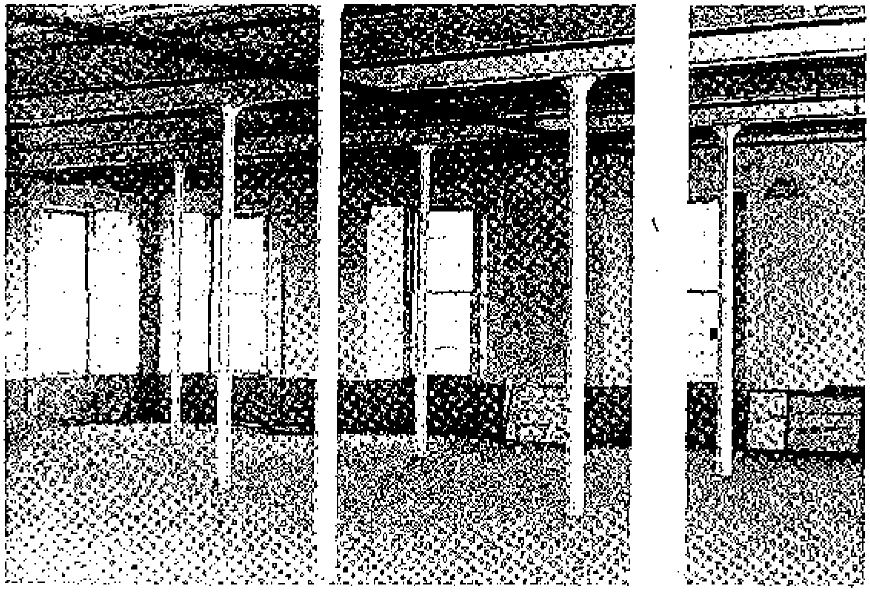


Illustration 27
Arsenal
Second Floor

1976

NPS Photo, DSC

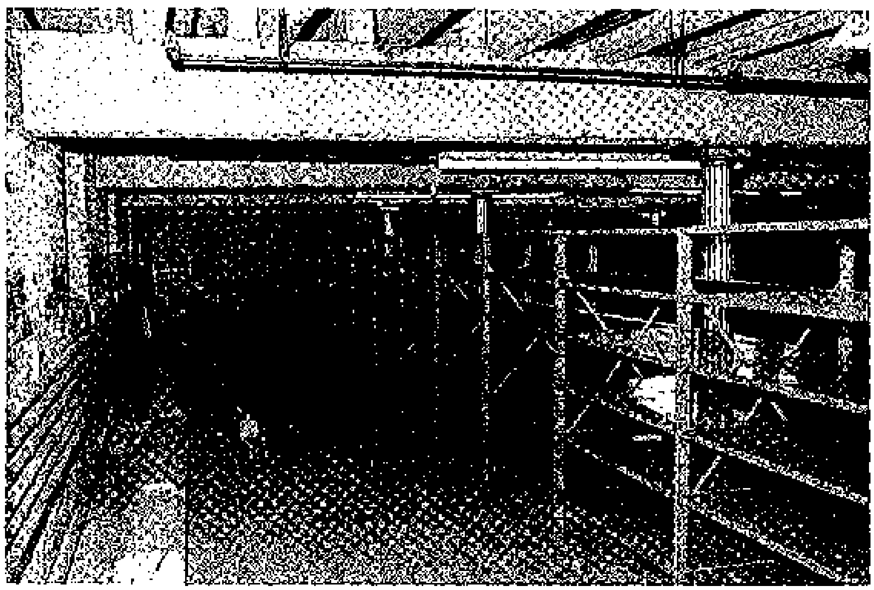


Illustration 28
Arsenal
Basement
Note pipe radiators along wall

1982

NPS Photo, DSC

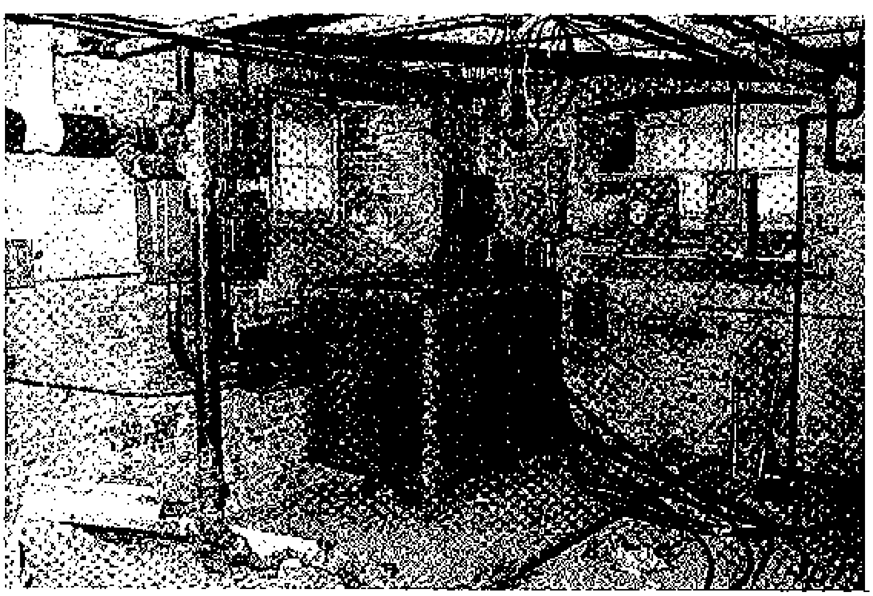


Illustration 29
Arsenal
Basement, Northeast Corner
Electrical Service Entrance

1982

NPS Photo, DSC

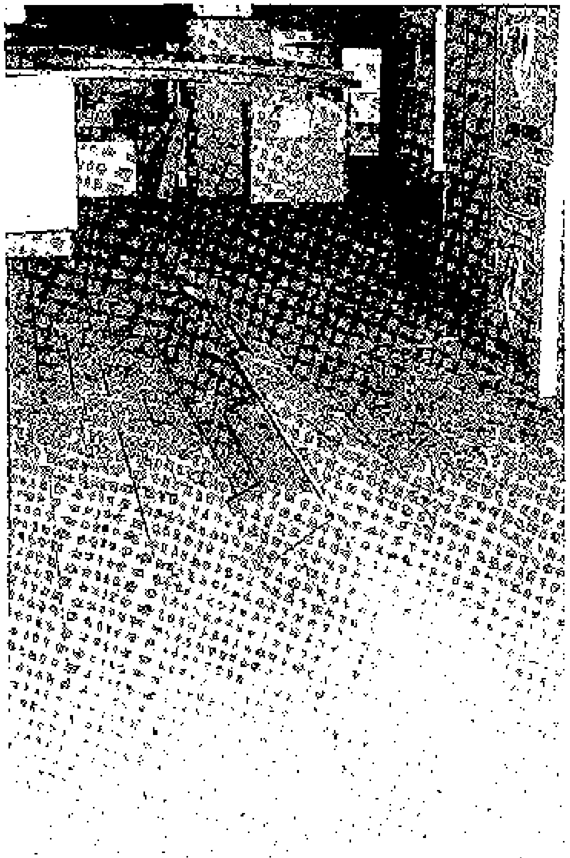


Illustration 30 **1976**
Arsenal
Second Floor
Buckled Floor Due to
Water Leakage

NPS Photo, DSC

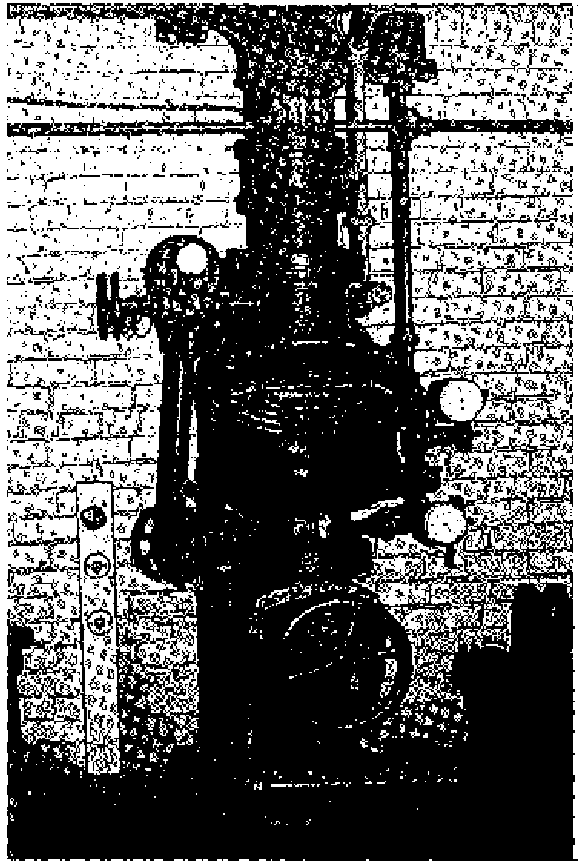


Illustration 31 **1976**
Arsenal
Basement
Sprinkler System Piping
and Valves

NPS Photo, DSC

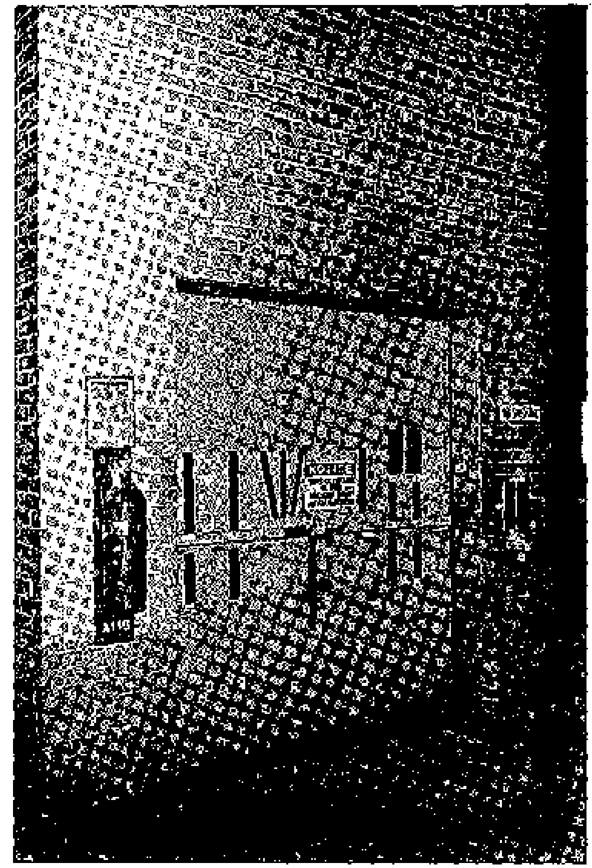


Illustration 32 **1982**
Arsenal
Basement
Elevator

NPS Photo, DSC

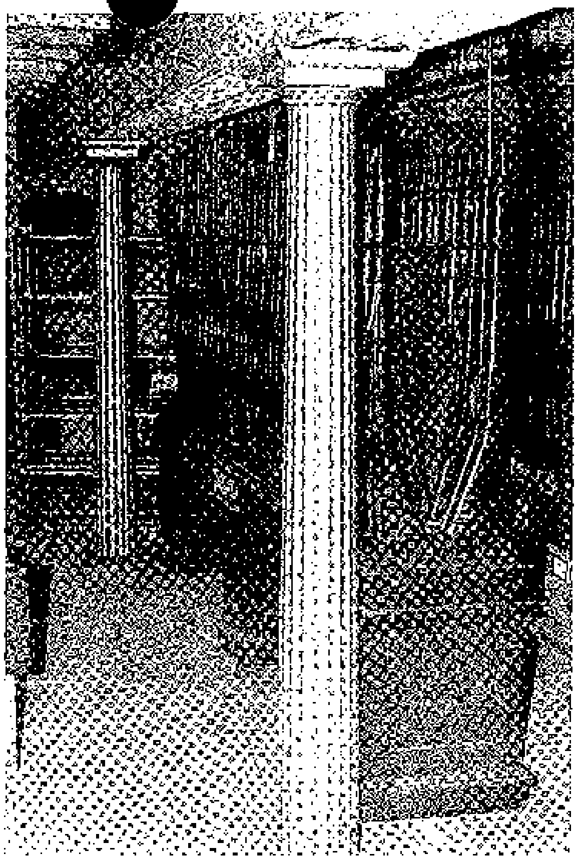


Illustration 33 **1976**
Arsenal
Basement

NPS Photo, DSC

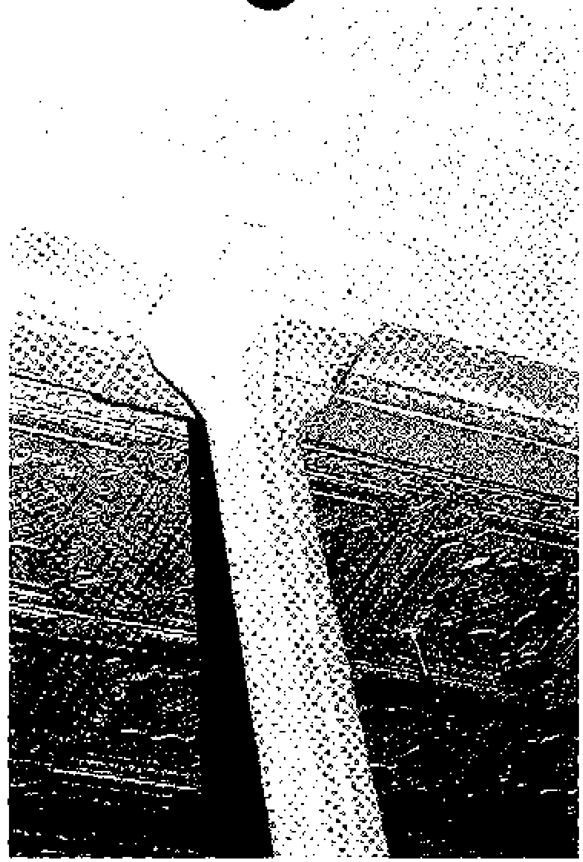


Illustration 34 **1976**
Arsenal
Second Floor
Column Detail

NPS Photo, DSC

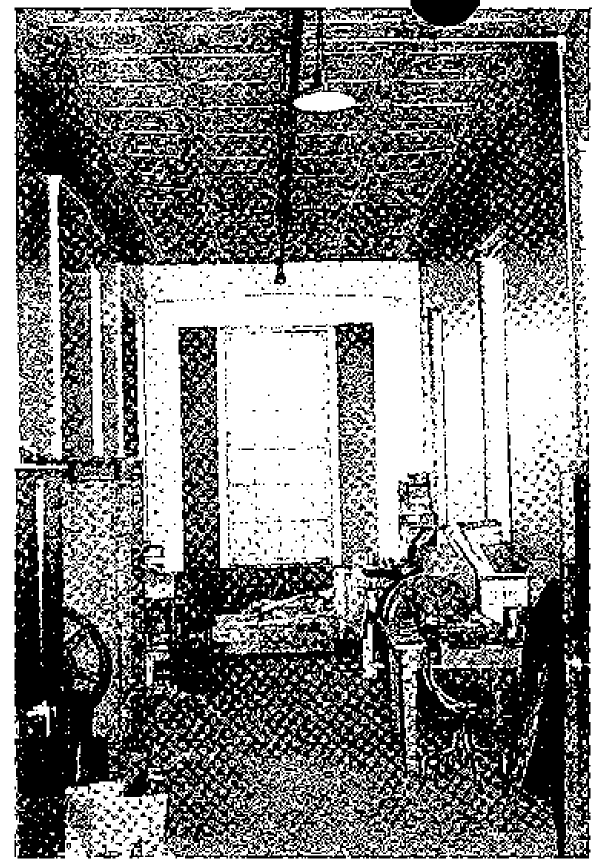


Illustration 35 **1976**
Arsenal
Second Floor
Pavillion, Looking Northwest

NPS Photo, DSC

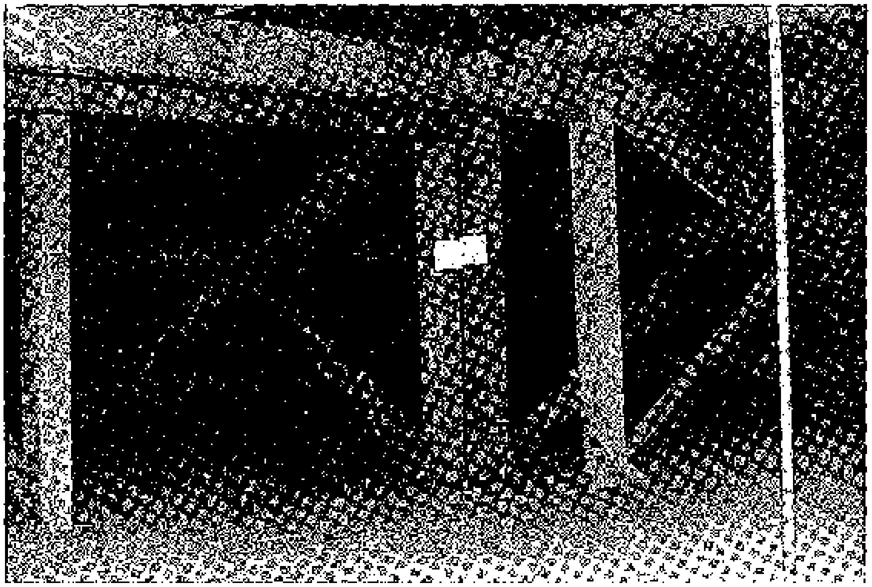


Illustration 36
Arsenal
Attic Framing

NPS Photo, DSC

1977

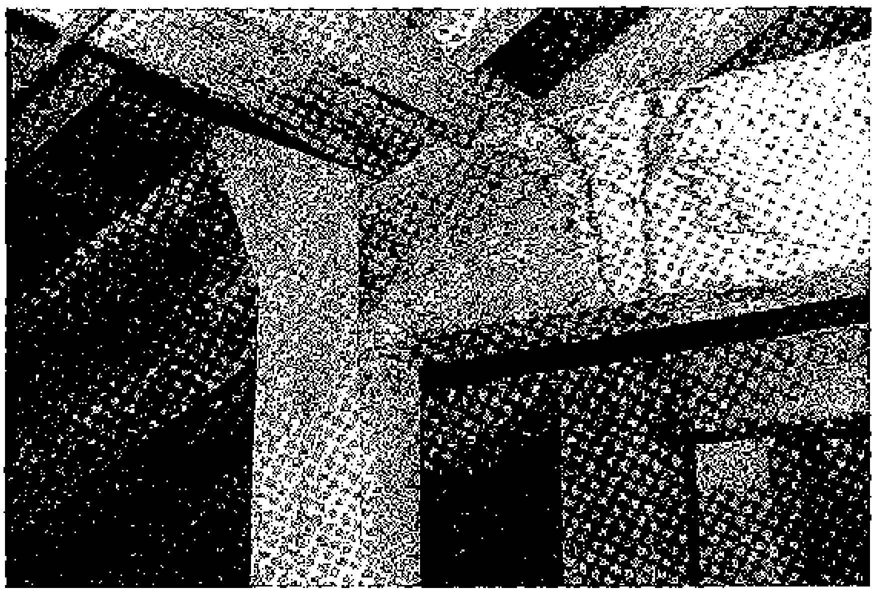


Illustration 37
Arsenal
Attic Framing
Note Water Stains

NPS Photo, DSC

1977

COMMANDING OFFICER'S HOUSE, BUILDING 1

III. THE COMMANDING OFFICER'S HOUSE, BUILDING 1

A. General Description and Evolution

The first Commanding Officer's House at Springfield Armory was located on the site of the Main Arsenal. That house was in existence in 1821,[1] and was one of the issues in the later Ripley-Stearns dispute.[2] Ripley initiated his development plan and the house was demolished in 1843.[3] The new (and existing) Commanding Officer's House was begun in 1845[4] and completed in 1847.[5]

The existing house is a large, imposing one, located to the northwest of the Main Arsenal. The symmetry of the two-story main section is contrasted by the two-story wing on the east side. A cupola terminates the hip-roofed main section. Clustered about the cupola are four chimneys. Symmetry is also the theme expressed on the facades where window or door openings in groups of three on both floors are consistent on all sides except at the wing attachment. Even at the center of the west elevation a false window opening is delineated in brick where the wall between the first floor parlors joins the exterior wall. Openings on the front facade of the wing are uniformly spaced. Only on the end and rear elevations of the wing is this regularity broken.

The house was designed in the Federal Period Classic Revival style. The original porches reflected the Greek Revival mode with Doric columns. The main entrance had a distyle portico. The west side of the

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1. Albright, John, "Historical Data Section, Historic Structure Report, Springfield Armory National Historic Site, Massachusetts," National Park Service, Denver Service Center, Denver, Colorado, May 1978, p. 6 and maps 2 and 3, pp. 9-12.

2. Ibid., pp. 21-25.

3. Ibid., pp. 23-24.

4. Ibid., pp. 24, 26.

5. Ibid., p. 26.

main section and the front of the wing each had a peristyle. These are shown in undated drawings of the house found in Armory files.[6] The only historic floor plans of the house found to date appear in an 1876 book of plans of buildings at various U. S. Armories.[7] These 1876 plans show the original porches. There are several differences between the undated elevation drawings and the 1876 plans.

The undated west elevation drawing from the 1967 report (Illustration 48) shows a window at the center of the first floor where the inset brick panel is seen today. The 1876 plan (Illustration 41), shows the inset, but no window. Whether the undated drawing is in error or the window removed and the opening filled is not known. If the later is the case, the wall between the front and rear parlors was added sometime between the original construction of the house and 1876. However, yellow ochre paint remains on the brick and mortar of the inset panel suggest that there was never an opening here; or, that the color scheme of the house changed from salmon to yellow ochre and red-brown by 1876.

The 1876 plan shows unroofed porches on each side of the main entrance portico. These are labeled "Balcony," with railings indicated. This feature does not appear on the undated elevation drawings but is shown distinctly in a c. 1884 illustration.[8]

The existing porch on the east end of the wing does not appear on either set of drawings, thus is probably post-1876, most likely early 20th century. It is interesting to note that the first floor doorway and window on the end of the wing are interchanged in position when the two sets of drawings are compared.

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6. See Illustrations 47 and 48.

7. Ordnance Department, <u>Plans of Officer's Quarters at the Arsenals and Armory</u>, Government Printing Office, Washington D. C., 1876; Military History Research Collection, Military History Institute, Carlisle Barracks, Carlisle, Pennsylvania. See Illustrations 39, 41, 43, and 45.

8. Albright, p. 72, Illustration II.

The 1967 report cited above states that the entrance, west, and wing porches were replaced with the existing ones about 1870. However, four illustrations post-dating 1870 still show the original porches. These are the 1876 plans, a c. 1876 illustration,[9] an 1877 map,[10] and a c. 1884 illustration.[11] Thus it can be concluded that the original porches were replaced by the Victorian-style porches after 1884.

Several other exterior modifications occurred but these did not affect the character of the house as much as the porch changes. Each sash of the double hung cupola windows was altered from 6 over 6 lights to a single pane. The wooden snow rails, similar in design to those on the Main Arsenal, were replaced with iron snow rails. The dates of these changes are unknown, but the snow rail replacement might have been about the same time as the porch replacements. This is assuming a decorative tracery was the desired effect.

The transom and sidelights at the main entry were changed possibly about 1900 as suggested in the 1967 report.[12] The original rectangular transom was replaced by an elliptical fanlight with a leaded glass design in both the fanlight and sidelights.

On the rear of the house, the bay window of the dining room was an addition as suggested by physical evidence.[13] The stonework of the lower wall facing is not integral with that of the main house wall and there is a basement window in both the bay wall and main house wall. However, the bay was in existence by 1876 since it is shown on the plans of that date.

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9. See Illustration 49.

10. Albright, p. 65.

11. Ibid., p. 72, Illustration 11.

12. Office of Archeology and Historic Preservation, Evaluation, p. 21.

13. See Illustration 72.

Two alterations post-date 1876. The window to what was originally the pantry (Room 105) was changed to a double door and metal steps were added. Also the portico of the rear wing entry was enclosed.

The second floor plan of the 1876 drawings shows a conservatory on the roof of the wing's front porch where the wing adjoins the main section of the house. This is not shown in other historic photographs or illustrations, and there is no visible physical evidence of its former existence.

Two dormers were added on the north corner of the main roof, replacing former skylights. The date of this change is unknown.

Except for the porch replacements, the only other major change which significantly affected the exterior character was the exterior wall treatment. The brickwork was originally painted salmon color. At a later time, the walls were painted yellow ochre with the pilasters, architrave, and frieze brickwork and projecting brickwork at door and window openings painted red-brown to match the stone work, which was never painted. The date of the change of color scheme is unknown. The paint was removed by sandblasting in 1937.

The first floor center entry to the main section of the house opens first to a vestibule then a larger hall. To the left, at the west side of the house, are the large interconnected front and rear parlors. To the right, the library occupies the front quadrant, the dining room the rear quadrant. Directly to the rear of the hall, a former pantry served the dining room as is shown on the 1876 plans. At some later time the doorway between the dining and pantry was closed (with a china cabinet built into the space) and a large opening cut directly to the hall, and the pantry window converted to a double door. With a set of steel steps, this gave access to the grounds at the rear of the house. Between the library and dining room, a hall running perpendicular to the main hall gave access to the northeast portion of the house, and a large staircase to the second floor.

At the joining of the main section of the house and the wing, a second entry vestibule connected the main stair hall and a service hall between the dining room, kitchens, rear stairs, and rear entry. The circulatory and functional arrangements here were later altered. The predominate uses of the wing's first floor were kitchen functions. The center of the three major rooms contained the cooking range, which no longer exists. Two storerooms, a pantry, water closet (bathroom), and the rear hall comprise the remainder of the space. The basement access is from the first kitchen.

The primary spatial arrangement of the first floor has not been significantly altered from that as shown on the 1876 plan. The major changes which have occurred since that time (other than finishes) are as follows: fireplace mantelpieces in the parlors, library and dining room; the conversion of the pantry to an anteroom to the center hall as described above; the addition of a bay window in the dining room as well as two china cabinets built into former doorways (one to the aforementioned pantry and one to the service hall to the kitchen); modifications to the service hall and closet, now a pantry between dining and kitchens; a door between the dining and stair hall closed with a closet added under the main stair; the addition of a lavatory in the wing vestibule; alteration of the rear stair to the second floor; installation of 20th century kitchen equipment and removal of 19th century kitchen range and cabinets; and the addition of a locker in the rear storeroom.

From 1964 to 1977 the house had suffered somewhat from lack of maintenance, heat, cleaning, and from some vandalism. Sometime during that period, a show of interior decorative schemes resulted in application of some inappropriate finishes and other materials which have or will cause damage to historic finishes by the necessity to remove them.

In 1977 the first floor, main section, of the house was put into use as administrative offices for the new park. Cleaning and minor repairs were done, most of the walls, ceilings, and woodwork painted, floors carpeted or retiled. Intrusion alarm, smoke detector, and telephone systems were installed.

The interior brick bearing wall system of the house established a second floor room arrangement similar to that of the first floor. The "T"-shaped central hall provides circulation between the main section and the wing. Each quadrant of the main section is a large bedroom, each separated by closets and bathrooms. The linear arrangement of the three wing bedroom repeats that of the kitchens below, with circulation, baths, and closets along the rear.

No major second floor modifications were made historically. All the bathrooms were modified sometime after 1876, and present fixtures were 20th century, ranging from early 1900s to the 1950s. Fireplace mantelpieces are reported to be original in the 1967 "Evaluation" report.

The attic ceiling surrounding the central interior hall is flat, then slopes to the perimeter walls, following the pitch of the roof. The ceiling meets the perimeter walls several feet above the floor. Ceilings and walls are plastered and for the most part unfinished. The plaster was applied to sawn lath nailed to 1 inch by 3 inch nailers. Nailers are perpendicular to the rafters, lath parallel. Rafters are 3 inch by 10 inch members at 24 inches (±) on center.

Each of the four roof slopes has three skylight positions. Skylights are rectangular except that over the stairwell, which is circular, and the two at the north corner which were converted to dormers. Existing skylight "sash" frames are metal with wire-reinforced glass. These frames are hinged on the upper end, secured to the curb of the opening. These "sash" units are replacements. Hardware remaining in the jamb faces of the openings indicate the previous (possibly original) units consisted of two leaves which opened somewhat like casement windows. Water leakage through the skylights has damaged the plaster faces of the openings.

The four brick chimneys which penetrate the attic are plastered. Deteriorated plaster on the upper portions indicates exterior flashing is in poor condition.

The rooms of east half of the attic are shown as bedrooms on the 1876 plan. The remaining area was left open.

A feature of particular importance is woodwork finishing in bedroom 303 and the large attic space, Room 304. Wood graining is found on some doors, base trim, trim around skylight openings, and the closet located on the west side of the central room enclosure.

At various locations in the perimeter kneewall are small openings (approximatly 8 inches by 9 inches) to the wall cavity. This 6 inch cavity is 10 inches from the interior wall face. Openings have iron doors. The function of the wall cavity is discussed in detail in Appendix B-5.

B. Existing Conditions - Exterior

1. Roof and Related Features

The hip roofs of the main section and wing are slated. The original roofing was slate as reported in 1847,[14] but the existing slate shingling dates from 1936. The signatures of slaters and tinners are found on the plaster in one of the attic skylights with the date June 1936. Later repairs are indicated by the light-colored patched-in slates on the wing roof and as indicated by a slate found with the date 1957. The existing slates on the main roof are 10 inches by 18 inches by 1/4 inch with a 7 inch exposure, medium grey in color. Slates on the wing are 14 inches wide with an 8 inch exposure, also grey except for replacement slates which are almost pink in color. Many repairs have been made with sheet metal inserts under the slates.

Roofing on the main porch is flat seam copper and exhibits occasional buckling. The front wing porch was previously roofed with copper and has been roofed over with composition roll roofing.[15] The

14. Albright, p. 27.

15. Material Condition Survey and Recommendations, Stull Associates, March 1979, p. 156.

porch on the east end of the wing is roofed with tar and gravel. All these roofs are flat hips. The flat hip roof of the cupola was not investigated.

Ridge and hip rolls are formed shapes of copper or lead-coated copper in approximately 8 foot sections. The cross section profile of that on the wing is slightly different than that on the main roof.

2. Flashings, Gutters, and Downspouts

Flashings at the cupola, chimneys, and at roof and wall intersections may date from 1936 when the roof was reslated. The flashing material is the same as the ridge and hip rolls but counterflashing is of a more flexible but heavier gauge metal sheeting, possibly a lead alloy.

Gutters are built into the stone cornice and lined with metal. This flashing extends part way over the fascia of the cornice and also some distance up the roof edge to provide a clear space for snow rail anchors. The flashing is covered with asphaltic-impregnated fabric. Some leakage of the gutters has occurred as evidenced by stains on the brick walls. Porch gutters are the external type.

Downspouts on the house are missing in some locations, allowing water to flood the walls and erode brickwork mortar. Some pieces of downspout anchors remain in the brickwork.

3. Snow Rail, Dormers, and Skylights

The snow rail standards are cast units anchored into the roof at 4 foot intervals. The three horizontal bars are pipe. Some elements are missing, requiring replacement. The paint on the snow rail is in poor condition.[16]

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16. See Illustration 77.

The main roof has three skylights on each of the four sides except the two on the north corner which were replaced with dormers. At the center of the east roof face is a round skylight over the stair well.[17] The existing rectangular skylight sash are metal, 27 inches by 47 inches, glazed with wire glass, hinged at upper ends. The curb and sash assemblies project 8 inches above the roof surface. Remains of hardware indicates that the original skylight sash units consisted of two leaves and swung out, hinged on the side rails of the curb. The existing sash open directly upward.[18]

The two dormers have Victorian period trim but side walls are finished with slate shingling. The hip roofs are finished with flat seam metal.[19]

Wood sheathing of the north wing face roof indicates the former existence of a skylight. This occurs over the attic room there which contained an early water storage tank.

4. Masonry

Between the first floor line and grade the walls are faced with red sandstone, forming a water table at the first floor line. The stone has a smooth finish with no tooling pattern. The facing blocks are set with very tight mortar joints.

The brick of the exterior bearing walls is a uniform red color. Wall surfaces are unadorned except for projecting pilasters (without capitals) at the building corners and first floor window and door openings of the main section, and projecting band and string courses beneath the cornice, again only on the main section of the house.

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17. See Illustration 74.

18. See Illustration 82.

19. See Illustrations 78 and 79.

The brick is laid with lime mortar, 1/4 inch joints, in running bond, there being no headers except at corners. Brick sizes vary somewhat, but typically are 2-3/8 inches by 3-7/8 inches by 8-1/4 inches. The brickwork was originally painted as on the Main Arsenal. The first color was salmon,[20] apparently retained on some buildings at the Armory as late as 1920. At some time, however, the Commanding Officer's House, and the Main Arsenal, were painted in a different scheme. Primary wall surfaces were yellow ochre, the window and corner pilasters, architrave and frieze were red-brown to blend with the color of the stone. Stonework was never painted. The yellow ochre and red-brown color scheme may have been in existence by 1876 or c. 1880.[21]

In 1937, the building was sandblasted to remove the paint.[22] Unfortunately, this also removed the smooth surface of the brick and the tooled mortar surface. The sandblasting did not remove all the brick surface or paint, however. On the northeast wall of the main section of the house above the wing roof is evidence of the original brick surface character. Where counterflashing was replaced in a slightly different position, the original hard, smooth face of the red brick was exposed. A noticeable amount of the brick surface was removed, creating a very porous surface. This evidence also indicates that there were some flashing repairs at a time after the 1937 sandblasting since roofing and flashing work was done in 1936.

Remains of paint can be found at various locations. On the south front wall, bits of yellow wash over the salmon can be seen on the mortar. Yellow wash on the mortar is also visible on the southwest

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20. Albright, pp. 17, 40.

21. Ibid., p. 68, Illustrations 8 and 9.

22. Photographs of the sandblasting work are on file at Springfield Armory.

side at the inset brick panel, or false window (which has a wood molding). Inspection of the walls will reveal all three colors--salmon, yellow ochre, and red-brown.

Except for the problems created by the sandblasting, the walls are for the most part, in good condition. Erosion of mortar has occurred on chimneys, the cupola walls, and where water has run down the walls at missing gutter locations. In some areas, efflourescence has occurred, such as on the east wall of the main section near the wing porch.

Cornices, window and door lintels and sills, and the facing of the walls between the water table and grade are red-brown sandstone. Some mortar has eroded from the tight joints of the facing blocks. Stone is in good condition except for some spalling and efflourescence, again for example at the east corner of the main section of the house.

5. Windows and Doors

The first floor double hung windows of the main section of the house consisted of three sash units, six lights in the upper and center units, three lights in the bottom unit. The sill is at the floor.

Cupola windows were originally 6 over 6 light sash, double hung, but are now one over one. The dormer windows are 2 over 2 light, double hung. Basement windows are 3 over 3 light, double hung. The remaining windows throughout the house are 6 over 6 light, double hung.

Windows are generally in good condition, although some sash and frame elements need replacement due to damage or deterioration. The windows characteristically suffer from excess paint build-up and dry wood. Paint build up obscured the details of the sash and trim sections. Interim maintenance painting simply adds to these problems.

Exterior doors are also in good condition but, like the windows, suffer from paint build-up and need minor repairs and refinishing.

The windows had shutters in 1876[23] and still had them at least as late as c. 1884.[24] Those photographs also provide evidence of the paint color scheme of the buildings. It appears that the buildings may have been yellow ochre and red-brown as early as 1876-80.

Many shutter pintles (set in the wood window jamb) and shutter dogs are still in existence. The shutter dogs are set in the stone water table at first floor windows. The metal is deteriorating and creating cracks in the stone.[25]

6. Porches

The cast iron work of the porch of the main section of the house consists of paired columns and triplets at corners. The pattern of the decorative spandrel sections is not a smaller mirror image of that of the railing. The wing porch has neither spandrels nor railings, and there is no evidence that these ever existed.

Porches are in good condition, some repairs having been done recently, mainly replacement of deteriorated trims at outer floor edges. Flooring has been repainted grey, the same as the previous color. Similarly, the ironwork has been repainted white, which also was the previous color. Excessive paint build-up has also become a problem on the ironwork. The new paint is cracking and peeling.

Two types of lattice construction can be seen between the stone-faced brick piers supporting the porch deck and columns. On the main porch, lattices are flat and overlapped, whereas on the wing porch, the lattices are set perpendicular to the plane of the panel, all in the same plane with a half-lap joint at each intersection. The lattice work has had recent repairs and repainting.

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23. See Illustration 49.

24. Albright, p. 72, Illustration 11.

25. See Illustration 80.

The porch on the east end of the wing is of a later period, possibly early 20th century. The four wood columns are tapered round neo-Doric typical of the early 1900s. The railing is made up of closely spaced wood ballusters.

7. Exterior Steps

Three sets of red sandstone steps, at the main entry,[26] at the west porch,[27] and at the wing entry,[28] are all in good condition only needing repointing. The metal hand rails at these steps appear to be a fairly modern installation and are in good condition.

Wood steps at the east end of the wing porch are in good condition but need a railing. However, the sandstone steps to the entry at the end of the wing are in very poor condition from erosion.[29]

The sandstone of the steps at the rear entry of the wing is in good condition but the stones have settled.[30]

8. Lightning Protection

The existing lightning protection system is historic, but it has not yet been determined that it is the original installed in 1847.[31] Air terminals are located on chimneys, cupola, and the ridge of the wing. Down conductors are braided cable.

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26. See Illustration 50.

27. See Illustration 66.

28. See Illustration 68.

29. See Illustration 81.

30. See Illustration 71.

31. Albright, p. 27.

In 1976, some of the down conductors were not connected to the ground rods, but this was corrected in 1977 and the system is functional.

9. Exterior Lighting

Exterior light fixtures on the building are not historic and are recommended for replacement with fixtures of a design characteristic of the period when electricity was supplied to the building, probably c. 1906.

10. Stormwater Drainage

Visible evidence suggests a subsurface drain system for roof stormwater, carried via the downspouts directly into clay tile drains possibly leading to the ravine northwest of the house. This system is clogged and now non-functional.

C. Existing Conditions - Interior

1. Structural System

Exterior and most interior walls are brick bearing walls. Typically interior walls are furred with vertical 1 inch by 3 inch wood furring strips at 14 inches (±) on center, to which was applied the wood lath and plaster. Basement walls were finished with paint directly on the brick.

Floor framing typically consists of 3 inch by 10-1/2 inch wood joists at 18, 21, or 24 inches (±) on center with 5 inch by 10-1/2 inch joists used at each side of fireplace or chimney stacks. Joists vary in depth from 9 inches to 11 inches. Rafters of the main roof are 3 inches by 10 inches at 24 inches (±) on center. Rafters of the wing roof are 2-1/2 inches to 3 inches by 5 inches at about 2 feet 6 inches on center.

Similar to the walls, the plaster and wood lath ceilings were installed on 1 inch by 3 inch wood furring strips at approximately 14 inches on center, perpendicular to the joists. Most of this ceiling system in the basement no longer exists although evidence remains.

Most existing finish flooring probably dates from the late 1800s or early 1900s. In the main section of the house, a wood overlay flooring was used, consisting of 5/16 inch thick wood of several types laid in several patterns similar to parquet flooring and with decorative border patterns. It appears that most original flooring still exists beneath the overlay and consists of wide tongue and groove boards, 7/8 inch thick.

On the second floor of the main section, the original flooring was installed on wood sleepers over 1 inch thick subflooring. The resulting space was filled with a plaster-like fill, used as a fireproofing or insulating layer. The first floor may also have been done in this way, but the attic floor was not. In the attic, wide but random width tongue and groove flooring, 7/8 inch thick, was applied directly to the 1 inch thick subflooring. Curiously, the flooring and subflooring run in the same direction.

2. Basement

a. Basement Rooms B01 and B01A; Passage, Coal Storage, and Furnace

The furnace space contained the primary unit of the extensive and unique system. This was later modified but the space can be viewed through an opening from the passage. Opposite the furnace, a door leads to the coal storage room, three steps down.

The only evidence to date would indicate that the heating system was converted from coal to steam about 1906 when the central steam plant was built at the Armory,[32] although modifications to the system are not inconceivable before that date, certainly after. The coal furnace is gone and the space is occupied now with only two banks

32. Albright, p. 78.

of heat exchanger coils (steam to air). A more extensive analysis of the heating system was performed by an engineering consultant.[33]

The 1876 plan shows openings from the furnace space to the building wall cavities.[34] These have been modified or closed up, present openings are probably to heat registers on the first floor or to vent flues. The 1876 plan also shows an opening to the furnace space from Room B07. This has been closed off with a brick wall on the furnace space side, leaving a very small space accessible through two still extant iron plate doors (opposing action, one swinging outward, one inward). A brick air tunnel under the floor connects with the heat exchanger in Room B04.

The opening from the passage to the furnace space has a sheet iron cover, which is in poor condition. The doorway between the brick paved passage and the coal storage also has an iron plate door.

The stone slabs of the original front porch can be seen overhead as the coal storage is entered. The coal storage extends along the front of the house beneath the porch. A brick vault springs from stone foundation walls. The brickwork was pargeted with lime plaster and whitewashed; whether the stonework was also pargeted was not determined. Round openings in the top of the vault near each end provided for coal delivery. The present porch renders these inaccessible.

b. Basement Room B02

The plastered ceiling is extant. Here and Room B03 are the only two basement rooms which still have the plastered ceilings. The wood lath was applied to approximately 1 inch by 3 inch (net) wood

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33. Commanding Officer's House Historic Heating System, Stull Associates, March 1979.

34. See Illustration 39.

nailers at approximately 1 foot on center perpendicular to the joists. The plaster is unfinished but sound although dirty and containing hairline cracks.

Walls are all brick, painted white, the most recent painting not relevant to the building history except probably being white. Dampness and mold from a sanitary drain leak occurs in the southwest corner.

Flooring is random width tongue and groove boards running north-south on wooden sleepers, probably over brick paving. The south window has been utilized for fresh air supply to the heat exchangers. The ductwork at the window connects with a brick tunnel under the floor. The area of flooring which had been taken up to construct the tunnel was re-floored with 3-1/4 inch wide tongue and groove flooring.

The two doors (leading to Rooms B03 and B04) are important features. They are four panel and have hand-painted wood grain finish.

c. Basement Room B03

Ceiling materials and condition are the same as in Room B02. Walls are also brick, painted white. The sanitary drain leak pointed out above (Room B02) is also affecting the walls and floor at the southwest corner of this room. Some shelving exists along the west wall.

The flooring treatment was the same as in Room B02 (random width tongue and groove boards running north-south on wood sleepers set on brick paving), but the center section of wood flooring has been removed, leaving portions running along the east and west walls.

d. Basement Room B04

The plaster ceiling is gone. First floor framing consists of 3 inch by 9 inch wood joists at 17 inches (±) on center, running east-west, with one row of bridging at the center of the span. Wood shims were used at joist bearings for leveling.

Walls are all brick, whitewashed, or painted white. Moisture has penetrated the east wall from a steam line leak at the floor.

The wood flooring (materials and construction similar to that in Rooms B02 and B03) is rotted around the brick heat exchanger enclosure, which replaced an earlier furnace shown on the 1876 plan, located near the northwest corner of the room.

e. Basement Room B05

This room is indicated on the 1876 drawing as a "Milk Cellar," with three closets along the west wall and sinks along the east wall. The closets exist but the sinks are no longer extant.

The only remaining plaster ceiling is over the closet at the south corner of the room. First floor framing consists of 3 inch by 12 inch wood joists at 15 inches (±) on center, running east-west except one running by each side of the fireplace support being 4-1/2 inches by 12 inches. The 3 by 12s between these larger joists are spaced at 18 inches to 19 inches on center. Joists were leveled with wood shims.

Walls are brick, painted white. Moisture was noted along the northwest wall. Closet walls are vertical tongue and groove boards, 1 inch thick, beaded one edge. Closets contain shelving. The wood four panel closet doors have unusual latch sets. Closet doors are painted grey.

The floor is now concrete, probably having replaced the typical historic wood flooring system over brick.

f. Basement Room B06, Passage

The plastered ceiling is gone but evidence on the brick walls and on joists is clearly visible. First floor framing joists are 3 inches by 8 inches at 17 inches (±) on center, running north-south. There are no wood shims at wall bearings in this room.

Walls are all brick, both whitewash and white paint are noted. Brickwork here is running bond with a header course each eighth course. Lime mortar was used. Moisture was in evidence on walls, possibly from leaks in the steam system piping.

Flooring is 1-1/4 inch random width tongue and groove boards running north-south on 1-3/4 inch by 4 inch to 6 inch sleepers spaced at 15 inches to 18 inches on center. Flooring is secured to the sleepers with cut nails, two to three at each sleeper. The wood floor system was laid over brick paving.

g. Basement Room B07

The plaster ceiling and nailers are gone except over the closet in the northwest corner of the room. Wood joists of the first floor framing measure 3 inches by 11-3/4 inches except those running by each side of the fireplace foundation which are 4-1/2 inches by 11-3/4 inches. Joists run east-west at a spacing of 15 inches.

All main walls are painted brick. The closet wall is of the same type of construction as those in Room B05. This closet is not shown in the 1876 plan however. The wood doors to Room B06, the closet and to Room B01 may also be hand grained but obscured by paint and dirt. The room side of the latter two doors were painted as a result of the interior decorator's show several years ago.

The wood flooring is similar to that of Room B06, also running north-south, but the level is approximately 1-1/2 inches lower. Springiness of the flooring indicates possible rot conditions exist.

Several generations of electrical service panels exist on the east wall.[35] This is the location of the historic and existing underground electrical service entry to the building.

35. See Illustration 92.

h. Basement Room B08

Again the plaster ceiling is gone, revealing the first floor framing. Joists are 3 inches by 9 inches at 17 inches (±) on center, running east-west.

All walls are brick, painted white.

The wood flooring is 2-1/2 inches wide (exposed face) tongue and groove, running east-west on sleepers. The flooring is rotted at the south end of the room where a steam condensate pipe is nearly split from rust.

In this room are examples of earlier lead sanitary drain piping. Wood strips nailed along the walls support the pipes, some of which are cut and bent shut. Sinks along the north wall shown on the 1876 plan are no longer in existence.

The stairway from the first floor opens into this room. The stairs are wood and there is one handrail, both are in good condition. The walls and ceiling are plastered and finished with white paint over wallpaper.

i. Basement Room B09

This room is indicated on the 1876 plan as the Laundry with an exterior entry at the northeast corner of the room: double doors and a short flight of stairs lead to the rear yard. At about the center of the east wall is a fireplace, at the north end of which is located a device with the notation "wash____" (?), the latter word possibly being "rack." This no longer exists, nor does a bank of four wash tubs in the south corner of the room along the west wall. In the southeast corner of the room, adjacent to the fireplace, a large brick mass with two cavities was constructed sometime after 1876, as it does not appear on that plan.

Again, the plastered ceiling has been removed. Lath was nailed to 1 inch by 3 inch (±) nailers at 1 foot (±) on center, running perpendicular to the joists. The joists are 3 inches by 11 inches to 12 inches and 4-1/2 inches by 11 inches to 12 inches, running east-west. Rows of 1-1/4 inch by 3-1/2 inch (±) bridging are at 4 feet 6 inches (±) on center. Wood leveling shims were used under the joists in the wall pockets.

Walls are all brick; the most recent finish is white paint, sprayed on. In the northwest corner of the room, and behind the enclosed lower portion of the stairwell, a partition forming a closet appears to be in a different position than shown on the 1876 plan, and the construction is of a later type than closets described previously in this text.

A large portion of the floor is the wood type previously described over brick paving, except portions at the west end of the room and along the east side where the brick paving is now exposed. The wood flooring at the south of the room is rotted due to a leak in a sanitary sewer line.

j. <u>Basement Room B10</u>

The 1876 plan shows a furnace at the north end of the room. This has been replaced by a brick enclosure occupying the majority of the space in this end of the room and projecting into space B11A. The enclosure is a steam-to-air heat exchanger.[36] Round metal air distribution ducts may have been reused.

Much of the remaining space is occupied by brick foundations for the fireplaces and cooking units on floors above. This typical support system consists of three parallel brick walls with brick vaults spanning the narrow spaces between. The "southerly" of these spaces is enclosed and at the floor is a small iron door. This may have been an ash box for the cooking unit above on the first floor.

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36. See Illustration 93.

The plaster ceiling is gone. First floor framing consists of 3 inch by 9 inch (±) wood joists at 17 inches (±) on center running east-west.

Walls are all brick with remains of paint washes and the flooring is brick paving. Materials, finishes, and conditions are similar to those described below for Room B11.

k. <u>Basement Rooms B11 and B11A</u>

Room B11 is indicated on the 1876 plan as a "wood cellar," B11A as a "water-closet." No opening is shown on that plan between the two rooms, but at a later time an opening was made, possibly when the brick heat exchanger was built. The heat exchanger partly projects into B11A and eliminated a doorway into the small space from Room B10.

Ceilings were originally plastered. As in other rooms, nails and nail holes in joists bottoms and bits of plaster on the walls at the ceiling line are evidence of the former ceiling. The wood joists, 3 inches by 9 inches (±) at 17 inches (±) on center, run east-west and are leveled with wood shims, usually 1 inch by 3 inches. Along the east wall of the building, joists bear on an 11 inch offset of the wall, with only one course of brick between the joists. Along this wall, there is some evidence of rot in joist ends and in the subflooring under the locker in the first floor storeroom. Subflooring consists of wide boards, 1 inch thick, running perpendicular to the joists.

Walls are all brick, running bond, typical of the work throughout the basement. As in Room B10, the majority of the paint washes are gone, but patches of whitewash remain with possible yellow wash beneath. There is some evidence of spalling of the brick from moisture but this may not be occuring at present. Small areas of repointing have been done at some recent time with cement mortar instead of lime mortar as the original work.

The flooring is brick paving, bed up, running bond, set dry in a sand bed. There was no evidence found that the paving was set in mortar.

3. First Floor

a. Room 101, Vestibule

The sidelights and overlight surrounding the main entrance door were replaced with leaded glass sidelights and fanlight c. 1900 as reported in the 1967 evaluation report.[37] The earlier design is also shown in one of the drawings in that same report.[38] The original overlight frame still exists. At the opening between the vestibule and center hall, the 1876 plan indicates possible sidelights there as well, which do not now exist. Broken glass in the entry door sidelights was replaced in 1977.

White acoustical tile was applied (before 1976) to the ceiling; the center ceiling suspended light fixture is 20th century.

Decorative pilasters flank both the entry door and the opening to the hall. Between the level of the plaster caps and the ceiling, the upper wall surfaces are finished with a decorative cornice of simple design, the predominent features being a cove at the ceiling and at mid-height a moulding with Guttae.

The plastered walls are otherwise plain. Near the center of the west wall, a vertical patch extends through the mouldings, likely to be a result of utility installations to the second floor.

The present simulated slate flooring is a 20th century replacement. A strip of marble slightly more than 1 inch wide can be

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37. See Illustration 50.

38. See Illustration 47.

seen along the entry door and a brass threshold plate extends across and under the sidelight panels.

In 1977, walls and woodwork were painted. A light tan water base flat paint was used on walls, an off-white gloss enamel on woodwork. All of the first floor, main section, has been done in this scheme with earlier finishes still in place except some walls where loose papers had to be removed. Heavy paint layering on woodwork presents some problems and future treatment needs.

b. Center Hall, Room 102[39]

The only significant change to the hall was the opening made to the former pantry sometime after 1876. The ceiling was painted flat, off-white in 1977. The paper and paint finishes show evidence of cracks and unevenness in the plaster. A center light fixture is suspended from a round plain medallion. The existing fixture appears to be fairly modern but is a design more appropriate to a c. 1900s era than others in the house. An intrusion alarm unit has been installed at the east corner of the room.

The pilaster and cornice treatment is similar to that of the vestibule, but with a picture molding beneath the cornice. Walls and woodwork were painted in 1977 as described previously. The main stair hall was closed off in 1977 with a temporary partition which is easily removable. The doors to the two parlors and the dining room are missing, although the latter may be one found in the basement. The library door is in place.

Carpeting was laid in 1977 over a patterned wood flooring which may have been laid in the late 1800s or early 20th century as a remedy for worn earlier flooring. This flooring is found throughout most of the main section of the house. It is typically thin, predominently

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39. See Illustration 53.

oak, laid to form approximately 1 foot squares parallel or diagonally to room walls and having some variation of border patterns. The heat registers in the floor at each corner of the south end of the hall are shown on the 1876 plan but both are positioned at the extreme corners.

c. Front Parlor, Room 103[40]

The only significant historic changes in this room were the fireplace mantelpiece (c. 1900), as reported in the 1967 "Evaluation" report, and the finish flooring.

The most recent finish on the plaster ceiling was in 1977--a flat white paint over the previous paints and papers. Some paint peeling has occurred. The surface is uneven and cracked, the result of periodic patch work. Room lighting presently consists of two fluorescent ceiling fixtures (4 foot, two tubes each). These were installed prior to November 1976.

The plaster walls retain their layers of historic paints and papers. They were painted light tan in 1977 with a water base flat paint. The previous finish was white paint. The cove moulding, which is typical throughout the main section of the house, has also been painted off-white. Wood door and window trim, and base trim are in good condition and were painted off-white enamel base. The previous paint was pink, applied prior to November 1976 for the interior decorator show and is not relevant to the building decorative history. Windows are in good condition, doors are missing. The double sliding door between front and rear parlors could possibly be in existence within the wall pockets, which have been covered with wood trim.

The splayed portions of the window jambs contain interior shutters, which have been rendered inoperable by numerous paint layers. This is true in much of the house.

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40. See Illustration 55.

The floor was carpeted in 1977. This was adhesive applied over a late 19th or early 20th century thin wood flooring overlay, predominantly oak, 1/8 inch thick, 2 inches wide, with a 2 foot 7 inch wide border in a parquet-type pattern.

The appearance of the c. 1900 fireplace mantel can be seen in a photograph of that period.[41] The overmantel is now missing. The 1977 enamel off-white paint covers the pink paint from the pre-November 1976 interior decorator show. The ceramic tile surround of the fireplace opening and the masonry of the firebox had also been painted. The fireplace is inoperable; masonry of the firebox back is broken.

A ceiling-mounted smoke detector has been installed above the left side of the opening to the rear parlor. An intrusion detector was installed at the northwest corner of the room. Wiring for these devices has been surface mounted and penetrates various mouldings in the rooms where installed. An air conditioning unit has been installed in the upper section of the front window, with surface-mounted raceway and switch on the jamb. The window sash is intact. Venetian blinds are presently used at the windows.

d. Rear Parlor, Room 104[42]

Sometime during the modern years of use of the house, acoustical tile was applied to the ceiling and a fluorescent light fixture installed, similar to those in the front parlor. Walls and woodwork were painted in 1977 in preparation for park office use. As in other rooms wall paint is light tan, flat water base, and woodwork is off-white enamel. The previous finishes (before November 1976) were

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41. See Illustration 55.

42. See Illustrations 54 and 55.

those applied for the interior decorator show: some of the orange wallpaper has been removed; woodwork was also white. Early wallpapers may still be in place.

The fireplace mantel is similar to and of the same period as the one in the front parlor. In recent years, bookcases were added along the north wall and part of the west and east walls. An intrusion alarm device and a ceiling-mounted smoke detector have been installed (1977) in positions on the opposite side of the wall from those in the front parlor. Venetian blinds have been installed at the windows.

The floor was also carpeted in 1977, applied over the historic wood floorings, which is similar to that in the front parlor.

e. Pantry, Room 105

Functionally and visually, this room is very different than would have been found in the 1870s. The 1876 plan shows it as a pantry opening directly to the dining room. The west and south walls were entirely taken up with cabinets--perhaps for table service and linen and a sink was located adjacent to the door on the east wall. These appurtenances were at some later time completely removed. The doorway to the dining room was closed, a china cabinet built into the opening; a large opening cut into the south wall, opening the space to the central hall; and the window converted to a doorway providing access to the grounds at the rear of the house. Perhaps the result of very different life styles, these modifications greatly changed the visual character of the central hall, allowed more light into the hall, and provided cross ventilation.

From the series of photographs estimated to have been taken during the early 1900s, a view of the entry hall gives a clue to the pantry changes.[43] The built-in china cabinet fills a door opening

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43. See Illustrations 53 and 58.

at the southeast corner of the dining room. That design is the same as that in the door opening to the former pantry. Thus these changes to the pantry and dining room could be deduced to have been made sometime between 1876 and the early 1900s.

In recent years, acoustical tile was applied to the ceiling. The walls are now plain except for a small wood cove moulding at the ceiling and a 1 by 3 board, running horizontally around the room at 2 feet 6 inches below the ceiling. Wallpaper which was applied for the 1976 or earlier interior decorative arts show was painted over in 1977 in the light tan as previously described. A rectangular (9-5/8 inch by 10-1/2 inch) vertical utility chase had been added in the northwest corner of the room, and another in the north corner, diagonally, 8 inches across. Woodwork is in reasonably good condition, and has also been painted white.

The center and lower sash units of the original window were replaced with the double door, which is fully glazed. The original trim of the opening is still extant.

Carpeting was installed in 1977 over the historic wood overlay flooring, similar in design and condition to that in the center hall (Room 102).

f. <u>Dining Room, Room 106</u>

In the 1967 report it is stated that the bay window was an historic addition to the house. Physical evidence bears this out as the stonework of the bay's foundation wall is not keyed into that of the house itself. The bay was added before 1876 as it is shown on the drawing of that date.

Interior historic changes were discussed in part previously in connection with the Pantry, Room 105. Again it is pointed out that the photographs estimated to have been taken in the early 1900s show the china cabinet built into the doorway which had earlier opened to the center service hall to the kitchen.[44] An identical cabinet was built into the doorway to the Pantry, Room 105. Another photograph shows a glass-fronted cabinet of similar design beneath the windows of the bay. This no longer exists.[45]

The 1876 drawing shows a doorway leading to the main stair hall (Room 107). The only evidence of the doorway's former existence to be seen in the dining room is a section of base trim about 7 feet long matched to the original. On the opposite side of the wall, within a closet built in beneath the stair, the original opening was left intact, and the door is still there.

The dining room was also painted in 1977--ceiling, cove, trim, fireplace mantelpiece, and doors in off-white, walls in light tan. Ceiling and wall paint is flat water base, woodwork paint is oil base, gloss.

Previous to November 1976 (probably done for the interior decorative arts show) finishes were: ceiling--painted, "mustard beige"; woodwork--yellow or "mustard beige" similar in color to ceiling; wall finish was not recorded.

The ceiling plaster is in good condition, although some hairline cracks are visible in the finishes. A decorative, circular medallion is still in place at the ceiling center, from which is suspended a modern light fixture.[46] The medallion has been painted the same as the ceiling, and is in good condition, but its material was undetermined. A smoke detector was installed in 1977 on the ceiling centered over the arch of the bay. Surface wiring was also run through holes bored through trims.

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44. See Illustration 58.

45. See Illustration 57.

46. See Illustration 90.

Walls and trim are in good condition, although woodwork has considerable paint accumulation. Earlier finishes remain on walls, including papers. The cove at the ceiling is the same simple design as found in the parlors.

A swinging door to the "closet," (Room 111) later a pantry, was missing in 1976, but in 1977 a similar door found in the house was reinstalled, although apparently from a different opening as it was reported to have been too long.

In the bay, scars and ghosts under paint may be evidence of the china cabinets which once existed here. An air conditioner has been installed in the top sash opening of the bay's center window, with surface-mounted raceway and switch. Sash and glass are intact. Windows are now fitted with venetian blinds.

The upper portions of the china cabinets built into the two doorways have double doors with leaded clear glass. Below these are double wood doors. These cabinets were built within the finished door openings, the original door trims retained.

The wood mantelpiece at the fireplace on the west wall is reported in the 1967 "Evaluation" to be from c. 1900, replacing the original, as in the library and parlors. The panel center of the overmantel appears to be plywood (painted white) and may have replaced a mirror. Modern bracket light fixtures on each side of the overmantel are mounted slightly lower than earlier fixtures. Ghost outlines of the earlier fixture plates are visible in the paint, and at the center of these, wood patches were fitted into the electrical box openings. The fireplace opening is set off with decorative metal trim; surrounding this is red ceramic tile, which also paves the hearth front. The firebox floor has a cement plaster over firebrick, the back is also cement plaster, possibly over firebrick. The splays appear to have a plaster coat with a simulated brick pattern tooled in. Some previous deterioration of the firebox was repaired in 1977.

In 1977, carpeting was laid over the historic wood overlay flooring of a similar type previously described in the center hall and parlors. The heat register near the southwest corner of the room is shown on the 1876 plan.

g. Main Stair Hall, Room 107

The primary feature of this space is the staircase, which is in good condition. The wood newel post, rail, and balusters are varnished. The decorative scrollwork on the carriage has been painted.[47] The underside of the stair is plastered, and was painted white. This paint was peeling badly, perhaps due to poor surface preparation.

Prior to 1977, the plaster walls were painted a very light grey over wallpapers and needed minor repairs. In 1977, walls were patched and painted light tan, woodwork painted off-white, as in the other rooms. Earlier finishes are in place.

The present green carpeting on floor and stairs existed prior to 1976. The wood flooring seen in the closet under the stairs is alternating random widths of light and dark tongue and groove. A smoke detector was installed (1977) on the ceiling over the door to Room 109.

h. Library, Room 108[48]

Materials and design features are similar to the parlors and dining room, but the library is in better condition. The 1977 work to prepare for office use was also similar: ceiling painted off-white, walls light tan, both flat water base paint; woodwork and trims painted off-white with oil base paint. The previous finishes were also paint (over papers), white ceiling and walls; woodwork was cream.

47. See Illustration 86.

48. See Illustration 56.

The ceiling and walls are in good condition, as are the cove moulding and woodwork, although the window shutters are not operable. Sealed into their jamb pockets by many years of paint application, they should yield good documentation of historic finishes when carefully opened.

There is no ceiling fixture medallion existing in this room, the present light fixture is modern. There is a window air conditioner in the upper sash section of the east window; and also in 1977, a smoke detector was installed on the ceiling over this window, and an intrusion detector in the west corner behind and above the door to the central hall. The door to the main stair hall is missing; the opening was closed-up in 1977 with trims remaining in place.

The fireplace is in fairly good condition, as is the mantelpiece, also c. 1900. The overmantel is gone, its previous existence is indicated under the finishes.[49]

The floor was carpeted in 1977, installed over an historic wood overlay flooring similar to that of the parlors and dining room.

i. Vestibule, Room 109, and Bath, Room 109A

This vestibule provides a secondary entrance to the house, and access to both the main stair hall and to the kitchen area of the wing. The entry door has not been changed in any major way, but the interior space was modified by the 20th century addition of a so-called half-bath in the east end.

Sometime after 1876 a doorway was cut between the vestibule and the kitchen, Room 120. When the bath was added, the doorway was closed-up and the door used for the bath. The door and

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49. See Illustration 83.

trim on the vestibule side is of the original design, possibly having come from one of three dining room doorways or a doorway between the passage and rear hall (Rooms 110 and 112, respectively). The doorway trim on the bath side is plain. Also sometime after 1876, an oval window was installed, now located in the "half-bath."

In 1976 the vestibule was in fair condition, but finishes in the "half-bath" were deteriorating. In 1977, minor repairs were made and surfaces refinished in both rooms. The following is a record of finishes information for those two years:

Vestibule, Room 109

Ceiling	(1977):	Water base flat paint, off-white
	(1976):	Paint, white
Walls	(1977):	Water base flat paint, light tan
	(1976):	Paint, lime green and wallpaper
Woodwork	(1977):	Repaired, gloss enamel paint, white
	(1976):	Had been patched, poorly done, painted, lime green except door to "half-bath" painted white
Floor	(1977):	Carpeted
	(1976):	Wood, finish worn and dirty

Bath, Room 109A

Ceiling	(1977):	Water base flat paint, off-white
	(1976):	Paint, white, peeling
Walls	(1977):	Water base flat paint, light tan
	(1976):	Northeast wall--wallpaper, blue and white pattern; Other walls--paint, blue, paint peeling, cracks in plaster
Woodwork	(1977):	Gloss enamel paint, white
	(1976):	Paint, blue
Floor	(1977):	Vinyl asbestos tile, blue
	(1976):	Linoleum, deteriorating

The flush valve toilet and lavatory have been put into operating condition.

j. Passage, Room 110

This passage originally provided circulation inter-connections between dining room, pantry, kitchen, the rear hall of the wing, and the wing entry vestibule. Modifications were probably made between 1876 and the early 1900s at the time of those done in the dining room. The doorway to the dining room was closed and counter and wall cabinets built along the west wall. The doorway to the rear hall (Room 112) was removed along with changes to the pantry (Room 111), which required relocation of the doorway to the kitchen (Room 120).

Ceiling and wall plaster, cabinets, and trims are in good condition, all painted a dark brown. This painting was done for the interior decorator show. The wood floor was covered in 1976 with beige linoleum, which was replaced in 1977 with blue vinyl tile.

The door to the pantry is missing, which may have been a swinging door. The door original to the existing kitchen entry may have been hinged on the kitchen side of the opening. The existing door is swinging, pivoted on the north side of the opening.

k. Closet, Room 111

This room would more commonly have been referred to as a pantry. As previously mentioned, modifications were made probably between 1876 and the early 1900s. The east wall was relocated, increasing the width of the room. Cupboard and wall cabinets were rebuilt along this wall. A sink was installed in the southwest corner.

The ceiling is lower than typical ceiling heights in adjacent rooms, probably to accommodate plumbing for the bathroom above. The finish material is 3-1/2 inch wide tongue and groove boards, painted white. Lower portions of the walls consist of a wood wainscot, also of 3-1/2 inch wide tongue and groove boards. Upper portions are plaster. The wall modifications resulted in cabinets of irregular depths. Some cabinet doors are glazed. Walls, cabinets, and trims are painted white.

The wood floor was covered in 1976 with a green linoleum, replaced in 1977 with blue vinyl tile. The counterweight ropes of the double hung window are broken, but the room is in good condition.

l. Hallways, Rooms 112 and 115

The hallways along the rear of the wing provide access to the various rooms, outside, and the rear stairway to the second floor. The pantry wall relocation had required a major change to the stairway. Originally a straight run, the lower section of the stair was rebuilt to a right angle turn with winders.

At some recent time, the ceiling has had an application of acoustic tile, except in the Room 115 portion, which is plaster, painted white in 1977. The plaster walls are in good condition, painted light tan in 1977. The previous paint color was yellow. The woodwork was painted white (enamel base) in 1977, and some broken glass was replaced in the rear door sidelights. The wood floor was covered in 1976 with linoleum, replaced in 1977 with blue vinyl tile.

m. Bath, Room 116

The room is shown on the 1876 plan as a "water-closet." The original fixtures are no longer extant. Existing fixtures consist of a flush-valve toilet and a lavatory, c. 1950s, both in operating condition.

The ceiling is 3-1/2 inch wide tongue and groove boards, painted white both in 1977 and previous to 1976. The walls are plaster except for the lower portions which consist of a wood wainscot, approximately 4 feet in height, constructed of wood boards similar to the ceiling finish material. Previous to 1976, walls and wainscotting were painted white. In 1977, walls were refinished with light tan water base paint, and the wainscot and woodwork with enamel base white paint. Linoleum on the wood flooring was replaced in 1977 with blue vinyl tile.

n. Storeroom and Locker, Rooms 117 and 117A

The wood food storage locker built within the original room was constructed sometime after 1876. Walls, ceiling, floor, and shelving are of cedar and in good condition. A window was installed in the north wall. Ice was supplied from the end porch of the wing through an opening high in the exterior wall. Water was drained to the basement, which has caused some rotting of flooring and framing.

The exterior window of the original room is not as large as shown on the 1876 plan. Moisture has caused finish deterioration--paint peeling from the plaster ceiling, paint, and wallpaper peeling from the walls. The east and west walls are paint on brick. The upper portion of the north wall is plastered, the lower 4 feet (±) is a wood wainscot of 3-1/2 inch wide boards. During preparation for refinishing of the room in 1977, loose paint and wallpaper were being removed. Paint was noted on the brick behind the missing base trim on the west wall. Woodwork was in need of repainting and linoleum over the wood flooring was in poor condition.

o. Room 118

The use of this room is not indicated on the 1876 plan, but was probably functionally auxiliary to the kitchens. Cupboards along the south wall no longer exist.

Paint and wallpaper on the plastered ceiling and north wall have cracked and peeled. The other walls are painted brick, the paint also cracked and peeling. Loose paint and wallpaper was removed in 1977 in preparation for refinishing. As in Room 117, some base trim was missing. Other woodwork was painted white. Linoleum covering the wood flooring was in poor condition.

p. Kitchen, Room 119 and Pantry, Room 114

The cooking range at the west side of this room shown on the 1876 plan no longer exists, nor do cabinets and a sink which were shown along the south wall. The space adjacent to the range in the southwest corner of the room has been closed off. Laundry tubs were installed along the east wall after this room was no longer used for cooking. The pantry, Room 114, does not appear to have been changed.

Paint on the plaster ceilings and walls of both the kitchen and pantry had peeled severely. Loose paint and plaster was removed in 1977 in preparation for repair and refinishing. The latest paint color was green. Woodwork and a wood wainscot of 3-1/2 inch wide boards to window sill height on the south wall were painted white and in need of repainting.

Historic flooring may be in poor condition as it appears that an underlayment was used under a linoleum floor covering, which is in poor condition.

q. Kitchen, Room 120 and Storeroom, Room 113

Whereas, kitchen, Room 119 was used for cooking, Room 120 was probably used for food preparation. As previously described, the doorway to the passage, Room 110, was relocated sometime after 1876. In this same wall, another opening had also been made to the vestibule, Room 109, and subsequently closed again. Modern metal kitchen cabinets, sink, dishwasher, and stove were installed, possibly c. 1950s.

The plaster ceiling and walls have a variety of finishes. Previous to 1977 refinishing, some finishes were probably applied for the interior decorations show. A brown floral-patterned paper covered the ceiling. The north wall and part of the west were papered, other wall areas were painted yellow, blue, and white. Some wood wainscotting was painted brown, baseboards blue. In 1977 the room was repainted--white ceiling and light tan walls--both with flat water base paint. Woodwork was repainted with white enamel paint. The linoleum floor covering was replaced with blue vinyl tile.

The storeroom, Room 113, is only slightly changed from its configuration shown on the 1876 plan. Pipe chases have been constructed and the shelving along the north wall is gone. The painted plaster ceiling and walls are cracked, paint is peeling. The last observed paint color was green. Woodwork was white, the floor covering was linoleum.

4. Second Floor

a. Hall, Room 201

In the landing section (the floor level corresponding to that of the wing) the predominant feature is the bookcase, built-in along the east wall. The narrow panel doors, glazed in the upper section, have a miniature entablature reminiscent of the door and window entablatures throughout the house. The lower center section contains a rollout seat and small desk. This feature is probably original to the house and is in excellent condition.[50]

In this portion of the hall, the ceiling is finished with acoustic tile. The walls are finished with a straw-patterned fabric wall covering. Woodwork is painted cream with a gloss enamel. The door to Hall 209 is missing.

As on the first floor, a patterned wood flooring overlay is probably early 20th century. The border consists of two strips of 2 inch wide oak, alternating with two strips of 7/8 inch wide straight-grained wood with a dark stain. The ground consists of 12 inch by 12 inch units of nine oak strips, each 1-5/16 inch by 12 inch, units laid alternatingly at 90 degrees. This flooring is in good condition.

The floor level of the main section of the second floor is 3 feet 3 inches above the floor level of the wing. The ceiling of the main hall here is also acoustical tile. The walls have had paint applied over wallpaper, except behind three large storage cabinets, where historic wallpaper and woodwork paint can be seen. The glass-fronted cabinets may date to the early 1900s and the top layers of wall and

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50. See illustration 87.

woodwork finishes sometime earlier. These cabinets fill the entire width of the hall at both north and south ends and the wall area between bedroom doors on the west wall.

The flooring is the same material and pattern as in the landing area described above. A section of flooring which had been taken up beneath a cabinet reveals significant information about flooring and framing details. The patterned overlay flooring here is 5/16 inches thick but is not tongue and groove. The previous, probably original, flooring is 7/8 inch by 4 inches tongue and groove laid on sleepers. The resultant voids were filled with plaster. The flooring finish was either brown paint or a stain and varnish. The subflooring is 1 inch by 9-1/2 inch (±). Joists are 3 inches by 9 inches at 15 inches to 18 inches on center, running east-west. The plastered ceiling of the first floor is installed on furring strips rather than directly to the joists. From the finished floor to the top of the ceiling plaster lath is approximately 15 inches. The brick bearing wall between the hall and bedrooms can also be seen here.

b. Bedroom, Room 202

Except for finishes, no major changes have occurred in this room. The original marble fireplace mantelpiece and the decorative metal opening cover are still in place and are in good condition.[51] The board and batten treatment on the ceiling is recent, and can be attributed to the interior decorator show. The surface is slightly higher than the typical plaster ceilings, leaving a gap above the cove moulding typical of the house.

The interior decorator show has left the ceiling and woodwork painted dark brown and walls papered. The late period flooring is 2-3/8 inches wide tongue and groove. The ceiling lighting fixture is modern.

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51. See Illustration 84.

c. Bath, Room 203

The 1876 plan shows a wash basin at the location of the present water closet, but does not show any other details. The portion which now contains a shower was a closet.

The ceiling now has acoustic tile and except for a ceramic tile wainscot, the walls have "decorator show" wallpaper. The floor is hexagonal small ceramic tile. Bathroom fixtures are not later than the 1950s. The closet section is finished with painted masonite sheets except the shower, which is tiled.

d. Bedroom, Room 204 and Closet, Room 204A[52]

The plaster ceiling and walls are in good condition but were painted dark blue for the "decorator show." The original cove moulding and woodwork are also in good condition. Woodwork is painted white. The patterned overlay wood flooring design varies from those previously described. Two bands, each consisting of a dark strip between two light ones, are separated by 12 inch squares made up of nine 1-5/16 inch strips, squares alternatingly laid at 90 degrees to each other. Inside the border, the alternating square units are laid at 45 degrees to the walls instead of parallel.

The fireplace mantel, also original, is identical in design to that of Bedroom 202 and is also in good condition.[53] Black paint has been applied to the brick of the firebox. Present ceiling lighting in this room is a flourescent fixture. A floor register adjacent to the fireplace is shown on the 1876 plan and is of the same design as those previously noted.[54]

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52. See Illustrations 59 and 60.

53. See Illustration 85.

54. See Illustration 89.

The closet, Room 204A, was undoubtedly a dressing room and closet. Flooring and base trim patches indicate the location of the wash basin shown on the 1876 plan. Paint on the plaster walls and ceilings is peeling. The inner closet is finished in painted wood shelving, walls, and lowered ceiling.

e. <u>Bedroom, Room 205 and Bath, Room 205A</u>

No alterations except finishes had been made to this bedroom, but the adjoining former dressing room and closet has been converted to a bathroom and a closet was added from space taken from Bathroom 206.

The plaster ceiling and walls have "decorator show" finishes, paint on the ceiling, and a floral-patterned paper on the walls. Woodwork is now white. Flooring is 2-1/2 inch wide tongue and groove oak with a simple border of two strips of light wood, 2-3/8 inches wide, separated by two strips of dark wood, 1-1/16 inches wide. The original marble fireplace mantel is in good condition. As with other fireplaces, the opening surround and firebox have been painted black. Existing lighting fixtures are two 4 foot, four tube flourescent fixtures.

The 1876 plan shows a wash basin in the position now occupied by a lavatory. The former inner closet was converted into a tiled bathtub/shower stall.

The most recent finish on the ceiling and upper portions of walls is white paint, which is peeling. Between this and a tile wainscot, the walls are papered, the last a "decorator show" application over a previous paper. Wall tile and shower doors appear to have been installed later than the floor tile, lavatory, and water closet.

The closet addition, which was formerly part of Room 206, was built sometime after 1876. A doorway was cut in the east wall of the bedroom between the fireplace and outer house wall. Part of the architrave of the window of Room 206 was covered by the added wall and the edge is seen in the closet corner. Cracked plaster and peeling paint characterize walls and the ceiling. The existing bedroom flooring appears to be fairly recent, possibly applied over the previous patterned flooring like that in Room 204. Similar diagonally laid units extend under a cabinet in the north end of the closet.

f. Bath, Room 206

The large dressing room and closet was also converted and has become a modern bathroom. A lavatory is now found in the location of a wash basin indicated on the 1876 plan. Most of the recent finishes are "decorator show" items. Ceiling and wall finishes are various paints, papers, and tile. Flooring is the small hexagonal ceramic tile. The original closet section now contains a shower and metal cabinets.

g. Bedroom, Room 207[55]

Except for finishes, the only change to this bedroom since 1876 has been the closing of an opening to the bathroom in the wing, Room 208. Materials and surfaces are in good condition but ceiling, walls, and woodwork have "decorator show" finishes. The historic overlay flooring is the same pattern as that of Bedroom 204. The marble of the fireplace mantelpiece is in good condition but the surround and firebox have been painted.

h. Bath, Room 208[56]

The bathtub and water closet shown on the 1876 plan no longer exist. As noted above, an opening to Room 207 was closed and the doorway to the hall relocated. Existing fixtures are 20th century. Some of the latest finishes are "decorator show" applications, such as the

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55. See Illustration 61.

56. See Illustration 88.

wallpaper above the tile wainscot. The ceiling is also papered. The bright, deep red paint on woodwork is also probably a "decorator show" finish. Flooring is ceramic tile.

i. Hall, Room 209

The 1876 plan shows curved stairs to accommodate the location of the bathroom door at that time. Since then the door was relocated and the stair changed to a straight flight across the end of the hall. Pipe rails have also been installed for railings. These wood stairs are painted dark brown. The plaster ceiling is painted white but is cracked. Plaster walls are painted pink. Woodwork is painted dark brown. These two finishes are probably "decorator show" applications. Flooring is the later period overlay, consisting of narrow but random width pine and a border of the same pattern as that in the adjacent hall (Room 201). Lighting fixtures are missing.

j. Hall, Room 210

The only apparent changes since 1876 were the installation of a doorway near the head of the stairs to the adjacent bedroom (Room 211) and a partition and doorway creating two hall sections (the other designated as 213 on the plan accompanying this report). The woodwork of these doorways was done with the same detailing as that original to the house.

Ceilings and walls of this hallway are painted (yellow). Woodwork is in good condition. The wood flooring is covered with linoleum.

k. Bedroom, Room 211 and Closet

The plaster ceiling is painted pink and at the walls is a small, plain cove moulding, also painted. Plaster walls are also painted. Windows have shutters which fold into the side jambs which are perpendicular to walls rather than splayed as in the main section of the house. Another characteristic of windows of the second floor in the wing is the lack of the inset wood panel beneath the sill as found in the main section of the house. Woodwork in this room is painted white. Flooring is random width, generally narrow, pine, with a border, although this does not contain members with dark stain.

The marble fireplace mantelpiece has been painted white. The surround of the opening, the firebox, and the inner hearth have been painted black. Lighting fixtures are either missing or in disrepair. Some electrical outlets and conduit are surface mounted. A heat register in the floor is located adjacent to the fireplace. In the northwest corner of the room, a patch in the flooring indicates the location of a wash basin, which is shown on the 1876 plan.

Since that date the closet has had cabinets and a plumbing chase added. The plaster ceiling and walls were last finished with blue paint. Flooring is similar to that of the bedroom.

l. Bedroom, Room 212 and Closet

There is no cove moulding at the ceiling in this room. The plaster ceiling has had a finish of textured paint, probably of "decorator show" origin. Walls have been painted a red-orange. There are no window shutters in this room. Flooring is wood with no border. The fireplace is similar to that in Room 211 except that the marble mantelpiece has not been painted. The closet has had some shelving added. Flooring is similar to that of the bedroom.

m. Hall, Room 213

Walls and the ceiling had last been finished with papers of "decorator show" application. Woodwork is painted beige, and the door to Hall 210 painted blue. The floor is covered with linoleum.

n. Bath, Room 214

Fixtures in this bathroom are of various periods, being replacements of those shown on the 1876 plan. That plan shows a water closet in the northeast corner and a sink in the southwest corner. The space that is now a closet for Bedroom 215 contained, as of 1876, a bathtub. This space could have been entered from both the bedroom and bathroom. The doorway to the bathroom side was closed up. The present bathtub in the bathroom may be c. 1900. The rim is trimmed with wood.

The ceiling and upper portions of walls have a "decorator show" application of floral pattern paper on the walls. The lower 4 feet of the walls is a wood wainscot of vertical beaded boards painted yellow. The remaining woodwork is painted white. Window shutters are operable. Wood flooring is covered with linoleum.

o. Bedroom, Room 215 and Closet

The 1876 plan also shows a wash basin in the south corner of the room, but it no longer exists. The ceiling now is finished with acoustic tile. Peeling wallpaper indicates moisture intrusion on the northwest and the two exterior walls. This was removed and plaster patched in 1977. The wallpapers were of "decorator show" origin. Woodwork is painted beige. Repairs are needed on windows. Flooring is tongue and groove oak of a later period.

The closet ceiling is also acoustic tile. Walls were refinished with wallboard and wallpapers, some of "decorator show" origin.

5. Attic

a. Stairwell and Hall, Room 301

Wallpapers on the plaster ceiling and walls have been painted white and are in good condition. Similarly, woodwork is painted white and in good condition. The stair and railing are in excellent condition, the rail varnished. Flooring is random width tongue and groove boards, painted. The most recent paint is brown, earlier paint was a lighter (medium) brown. A circular skylight is located over the stair landing.

b. Interior Hall, Room 302

This room, at the center of the house, contains the stairway to the cupola. The room is in good condition but the ceiling and walls have "decorator show" finishes. The ceiling has a textured paint and walls are painted. The wide, random width tongue and groove flooring is painted dark brown over a medium brown. Balusters and treads of the stair have been painted and are in good condition. The railing and newel post have varnish finish and are also in good condition.

c. Bedroom, Room 303

Plastered walls and ceilings are unfinished. Plaster is dirty and has hairline cracks. Woodwork is grained and the wood flooring is painted.

d. Room 304

The condition of plaster ceilings and walls in this large area is similar to that in Room 303, but some has fallen as a result of roof leakage. The grained woodwork is in good condition.[57] The wood closet with rounded corners on the south side of the center room section has had brown paint applied over varnish. The door is mahogany.

e. Bedroom, Room 305

The exterior trim elements of the two dormers suggest that these dormers replaced the original skylights sometime in the late 1800s. Interior walls and ceilings of the dormers are wide tongue and groove boards, beaded on one side, and painted grey. The plaster ceilings and walls of this room had been painted yellow ochre. Woodwork is painted grey but some is missing. A closet in the southwest corner of the room is a later addition as is some surface-mounted electrical work. The electrical wiremold is wood.

f. Attic of Wing, Room 306

The wing of the attic is unfinished except for this space, which is accessible from the second floor hall by a narrow, steep stairway. The 1876 plan indicates a water tank to have occupied this

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57. See Illustration 94.

space. The tank is gone, but the raised section of floor still has a protective covering of flat seam metal roofing material and some remains of plumbing.

g. Cupola, Room 401

This pleasant space atop the house provides a panoramic view of the Armory and portions of the city and surrounding hills. Each sash of the double hung windows, originally six lights each, are now single light sash. Plaster ceiling and walls, woodwork, and flooring are in good condition. The plaster cove moulding at the ceiling is the same section as the cove in the dining room.

All visible finishes seen in 1977 appeared to have been of "decorator show" origin. Paint colors chosen were the most sympathetic of any in the house. The ceiling was white, walls yellow ochre, woodwork tan, and wood flooring medium brown. The previous paint color on the flooring was dark brown. Investigation of the cove moulding revealed the following paint color sequence, beginning with the earliest:

1. Grey
2. Yellow Ochre
3. Green
4. Mustard

D. Building Systems

1. General

As in the case of the Arsenal, R. G. Vanderweil Engineers, Inc., conducted a survey of the building systems (Appendix B-1 and 2) which was used by management to make basic systems decisions.

2. Water Supply and Sanitation

The house is serviced from the Armory central system operated by STCC. All the bathrooms were modified after 1876, and the existing fixtures date from the early 1900s to the 1950s. Existing fixtures are in operable condition.

The sanitary piping shows evidence of leakage in Rooms B08 and B02. Inoperative original 2 inch lead water piping remains in the basement.

3. Environmental Controls

The original heating system appears to have been gravity hot air with coal-fired furnaces. The system was probably converted to steam with the construction of the Armory central steam plant in 1906. R. G. Vanderweil Engineers, Inc. prepared a more detailed analysis of the Commanding Officer's House historic heating system which discusses development of the system (see Appendix B-5).

4. Electrical System

The present electrical power service consists of an underground 575V, one phase, two wire primary power to a 37.5 KVA, 115/230V, three wire dry-type transformer, which was relocated from Building 22. Voltages are incompatible with contemporary voltages. Wiring in the building is generally antiquated, but is unsafe due to the lack of a grounding system.

5. Security System

The Commanding Officer's House is protected by a fairly new intrusion detection system monitored by a local security firm.

6. Fire Detection

Fire detection is provided on only the first floor of the main portion of the house. The system is monitored by a local security firm.

7. Fire Protection

The only suppression system is hand-held extinguishers located throughout the building.

8. Fire Egress

Exits are conventional residential exits without panic devices. Exits are adequate for intended uses.

E. Recommendations

1. General

The following recommendations for Building 1 are presented within the context of the management decision that the period of restoration should be 1968, the closing of the Armory. The existing conditions today generally represent conditions in 1968, since only minor changes have been made since 1968.

The recommendations made here deal primarily with the actions required to preserve and stabilize the Commanding Officer's House, adaptive use questions will be addressed later in preliminary design. Exterior treatment recommendations will be addressed first and interior treatment recommendations will follow.

2. Exterior

a. Masonry Walls, Trim, and Chimneys

Both brickwork and stonework should be repointed with lime mortar (see Appendix B-4 for formulations). Partial repointing is anticipated since portions of the existing pointing appear sound. The methodology for repointing should be controlled to minimize mortar staining. Cleanup should be with water only. Since the existing sandblasted brick surfaces are weathering well, sealants should not be considered at this time. Before use of fireplaces or use of existing flues for new mechanical system the flues should be inspected and repaired or lined if necessary.

b. Roofing

(1) Slate Roofing

All slate roofing and minor amounts of slate siding on dormers should be replaced. An inspection by a slate roofing contractor indicated that simple repair of the roof would not ensure a sound roof and a cost effective installation, due to the extensive and failing existing repairs and damaged slate.[58] Board sheathing should be inspected when exposed and replaced if damaged.

(2) Main Porch Roofing

Replace existing leaking copper roof with new copper roofing, with heavier sheets where second floor downspouts empty onto the porch roof.

(3) North Wing Porch Roofing

Replace composition roofing on wing porch with copper roof to match main porch.

(4) Wing End Porch Roofing

Replace tar and gravel roof with copper roof.

(5) Cupola Roof

Replace metal roofing with new copper roofing.

(6) Dormers and Circular Skylight

Replace metal roofing with lead-coated copper and then paint.

c. Flashings, Gutters, and Downspouts

(1) Flashing

Flashing has deteriorated at almost all roof edges, ridge caps, porch to structure connections, and penetrations through the roof, i.e., chimneys, skylights, and dormers. Given the need to replace the majority of roofing, all flashing should be replaced using copper or lead-coated copper if it is to be painted.

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58. See Appendix B-3.

(2) Gutters

Existing copper gutters exhibit extensive deterioration, therefore all gutters should be replaced as in the case of the eave flashings.

(3) Downspouts

Copper downspouts are missing or have open seams. All down conductors should be replaced with new copper down conductors.

d. Snow Rail

Rail should be repaired, involving replacement of missing castings, replacement of deteriorated piping, and refinishing. Existing bracket anchorages should be evaluated for structural adequacy when exposed during construction.

e. Skylights

In addition to replacement of flashings, the metal frame should be repaired and wood trim repaired. Slater's signatures and dating near one of the skylights should be preserved.

f. Dormers

In addition to flashing and roofing replacement, wood trim should be repaired and refinished.

g. Air Conditioners

Remove window air conditioners.

h. Remove Aluminum Storm Doors and Windows

Provide wood-framed screens, storm doors, and storm windows after doors and windows are refinished.

i. Doors and Windows

Basement and second floor windows exhibit the most deterioration, and most replacement of damaged wood elements would occur on these windows. The general procedure for treatment should be as follows:

(1) Remove loose and peeling paint with scrapers and sandpaper.

(2) Replace deteriorated wood elements with new of wood type and cross section to match existing. Make all sash operable and provide for fixed or operable sash as desired.

(3) Apply linseed oil and turpentine mixture to bare wood.

(4) Scrape and sand.

(5) Apply second coat of linseed oil and turpentine mixture.

(6) Back prime.

(7) Putty glazing and apply wood filler, sand.

(8) Prime with oil base primer.

(9) Date work.

(10) Apply finish coats.

j. Shutter Hardware

It is recommended that existing shutter hardware be preserved in place. Pintles should be examined for paint history, cleaned of excess paint, and refinished. Shutter dogs set in the sandstone water table are recommended for replacement in bronze to stop the effects of rust and cracking in the stone. Before setting new dogs, a stone polymerizing adhesive is recommended to stop the advancement of cracks and close them to water intrusion. Impregnation may be possible using the slot for the shutters dog before installation so the exposed faces of the stone will not be affected.

k. Porches

(1) Cast Iron Porches

Repair or replace damaged ceiling boards, trim, and floors. Inspect porch structural system at time of construction and replace any rotted porch framing with treated members. On cast iron columns remove built-up paint layers using low pressure sandblasting and refinish (see Appendix B-4 for Munsell coded list of cast iron finishes). Replace damaged column bases.

(2) Wing End Porch

Repair or replace damaged ceiling boards, trim, and floors. Inspect porch structural system at time of construction and replace any rotted framing. Repair and replace rotted railing.

l. Exterior Stone Steps

(1) Wing End Steps

Replace severely deteriorating steps with new matching sandstone.

(2) Rear Steps

Reset and point steps.

(3) Main Stone Step

Repoint all other steps.

m. Lightning Protection System

System should be preserved and maintained in operable condition.

n. Subsurface Drains

Clean and repair existing drains. Observe operation of cleaned drain and evaluate need for new drains.

3. Interior

a. Basement

Recommendations for the various basement rooms can be grouped into general actions for the majority of spaces and action for specific features. The basic goal of the actions is preservation of 1968 or existing conditions. The following general actions should be carried out in all spaces.

(1) Clean All Surfaces

General housekeeping is the first portion of work, removal of trash, and general debris. From there surface cleaning will range from simple vacuuming to cleaning with mild soap or non-ionic detergent. Cleaning methods should preserve existing finishes. Wood framing for example should simply be vacuumed.

(2) Repair Masonry and Frame Walls

Repairs should be made to match in general the existing construction. Brick repair will involve repointing with lime mortar and occasional replacement of damaged brick. Replacement bricks should match existing in size, color, texture, and hardness and be marked with the date of replacement. Parged brick in the furnace space and Room B01A should be repaired using pargeting of similar formuation to the existing. Possible moisture problems were noted in Rooms B05, B06, B07, B08, B1, and B11A. Prior to refinishing, walls should be monitored after completion of roof drainage system repairs and repointing to determine if the moisture has been eliminated.

(3) Repaint and Refinish Walls, Trim, and Windows

Existing colors and types of finishes should be matched. The predominent existing and historical finish was whitewash, and whitewash or waterbase paint should be used.

(4) Wood Floors

Areas of wood flooring will require replacement where rotted and damaged. During replacement of flooring, sleeper should be inspected for damage and replaced if required. Floors in Room B08 appear to to require replacement of flooring and sleepers.

b. Basement Miscellaneous

In addition to the above more universal recommendations for treatment of the basement spaces, the following specific recommendations are made:

(1) Furnace Space

Iron plate access covers and doors should be cleaned of rust and a protective finish applied.

(2) Plaster Ceiling, Rooms B02, B03

Clean and repair hairline cracks in plaster. Do not paint these surfaces.

c. First Floor

The first floor is in generally good condition, and existing conditions reflect conditions as they existed in 1968. As in the basement several general actions can be recommended, but they might not be applicable in absolutely all spaces. First floor spaces impacted by the post-1968 "Interior Decorator" show had been recently repainted in generally neutral white.

(1) Carpet

Remove recent glue-down carpet installation. Historic wood flooring below should be refinished (varnish and wax), the difficulty of this operation will depend upon removal of the carpet adhesive. It is recommended that machine sanding be avoided and hand methods will permit restoration of the finish.

(2) Air Conditioners

Remove window air conditioners.

(3) Cleaning

Soiled surfaces should be cleaned using minimal impact methods such as simple vacuuming and cleaning with mild soaps or detergent.

(4) Door and Window Hardware

Retain historic hardware.

(5) Window Shutters

Restore window shutters to operable condition, repairing, and refinishing woodwork where necessary.

Several specific recommendations must also be made concerning first floor spaces:

(1) Contemporary Partitions, Room 102

The partition closing off the room could be removed if tenant needs require. However, a method controlling smoke migration to other areas of the house should be considered at the stairs to the attic. Also, should only part of the building be occupied the partition should reduce heating bills.

(2) Kitchen, Room 120

Disposition of the existing kitchen equipment should be ultimately determined by tenant needs. If the kitchen function is desired the equipment could remain, or the kitchen could be remodeled. If kitchen facilities are not required the space could remain as is; or adaptively used for rental space and the equipment removed.

These actions would establish a basic condition on the first floor which would allow leasing at a generally low income level and little capital expenditure by the National Park Service.

d. Second Floor

The second floor spaces suffer from the "Interior Decorator" show finishes which were introduced after 1968. To provide general leasing space similar in quality to the existing first floor spaces, several general actions must be taken on the second floor.

(1) "Interior Decorator" Show Finishes

Basically only wall, trim, and ceiling finishes were altered for the show. Physical alterations such as board and batten ceilings should be removed and concealed plaster repaired. Where wallpaper is paintable, it should be painted in off-white. Where wallpaper is unpaintable (metallic, damaged, etc.) remove the most recent paper layer and paint that surface. Repaint trim and walls.

(2) Floors

Repair and refinish wood floors. Machine sanding should not be used, where patterned parquet floor is present. Light machine sanding would be acceptable on other flooring.

(3) Bookcases and Railings

Gently clean wood and maintain with a good furniture polish.

(4) Window Shutters

Restore window shutters to operable condition, repairing and refinishing woodwork where necessary.

(5) Tile Floors

Clean and regrout tile where deterioration has occurred.

(6) Fireplaces

Remove paint from tile and marble surfaces and clean.

e. Third Floor, Attic

The third floor space is not particularly suitable for leasing space, so proposed actions are oriented toward simple preservation. When the roof and flashings have been repaired, deterioration of plaster and finishes should be curtailed. It is recommended that the attic of the wing be left in its existing condition. No work is needed except thorough vacuuming to remove accumulated dust. There are some loose items which are recommended to be catalogued and kept in a park collection of building artifacts. The following general actions should be taken in the attic:

(1) Cleanup

Walls, woodwork, and flooring should be cleaned. Cleaning is the only proposed treatment for the grained woodwork in Rooms 303 and 304.

(2) Plaster Walls and Ceiling

Remove deteriorated plaster caused by water leakage. Replaster and repair cracks. Refinish to match existing colors.

(3) Flooring

Repair and repaint to match existing finish.

(4) Stair Railing

Repair, reinforce, and repaint railing.

f. Cupola, Room 401

(1) Walls, Ceiling, and Floor

Clean, repair, and refinish. Finish should correspond to those prior to painting for the "Interior Decorator" show.

(2) Railing

Repair and reinforce railing particulary if visitor access is to be permitted.

4. Building Systems

a. Water Supply and Sanitation

Existing linkage to the Armory central system should be maintained. Damaged cast iron sanitary drains should be repaired.

b. Environmental Controls

A basic modification of the exisiting system is recommended. Stull Associates performed an analysis of several system alternates, a summary of which can be found in Appendix B-1 and B-2, and the complete analysis in the supplemental reports. The selected alternative involved new boilers, to replace the existing steam service. The existing flue would be used and controls would be added to the system. Long-term modifications would involve conversion to a hot water system.

c. Electrical System

The house should be rewired and new electrical service provided (see Appendix B-1 and B-2). Determination of possible tenant requirements and proposed uses will impact electrical system design.

d. Security and Fire Detection Systems

Both systems should be expanded, particularly fire detection to the attic, to ensure adequate protection. An NPS-owned system integrated with the Arsenal system is recommended. Equipment should be concealed to the extent possible.

e. Fire Protection

Suppression systems are not recommended at this time given costs and assuming an upgraded detection system.

f. Fire Egress

No modifications are required.

QUARTERS OF THE COMMANDING OFFICER.

Illustration 38
1852 C. O.'s House, Note Lack of Wing Porch and Existence of Fence 1852
Harper's New Monthly Magazine, 1852; Negative No. SA1467,
NPS Park Files

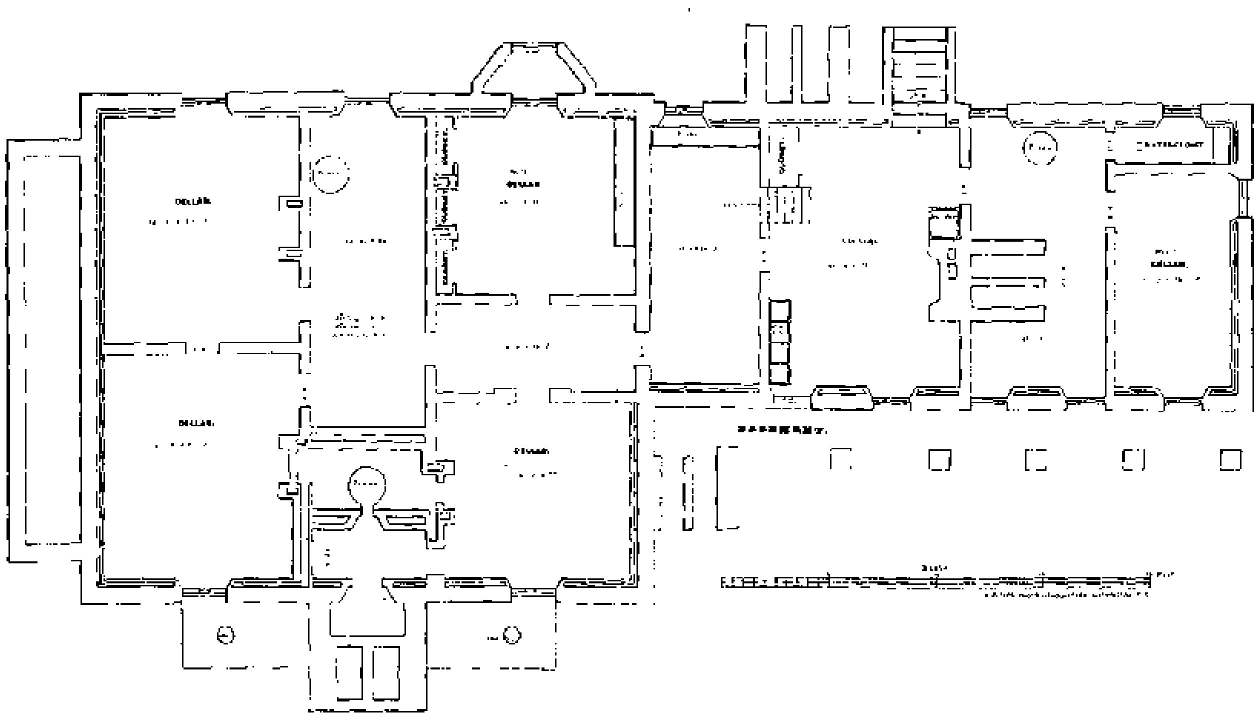
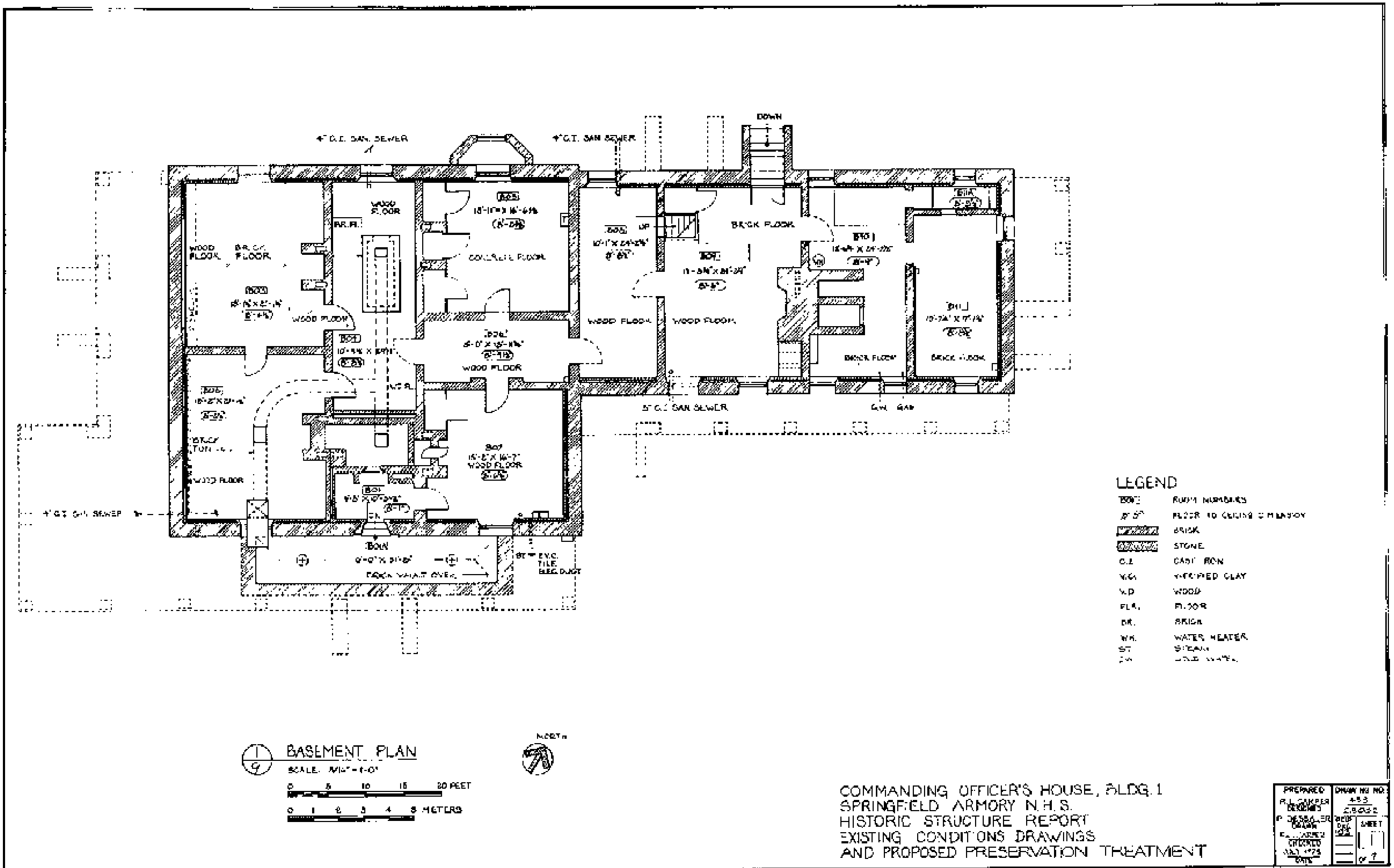


Illustration 39
C. O.'s House, Basement Floor Plan, 1876
Officers' Quarters at the Arsenal and Armory, GPO, 1876

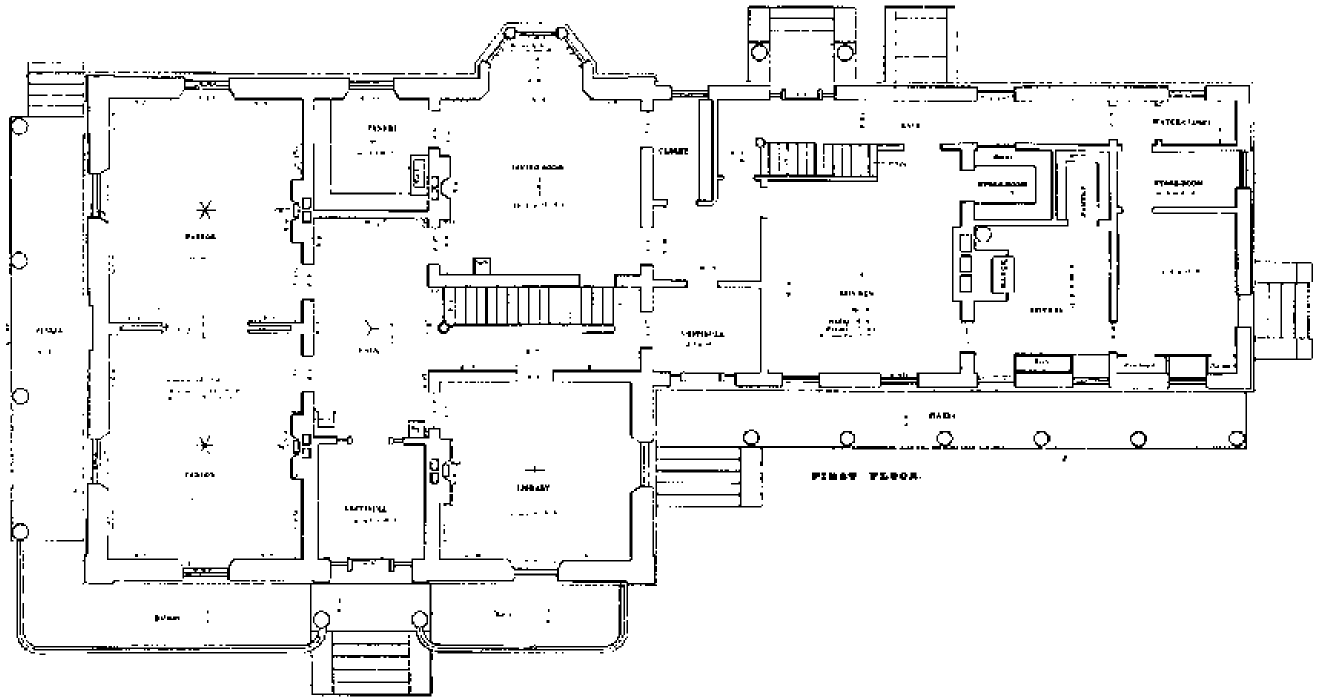
1876



1977

Illustration 40
C. O.'s House, Basement Floor Plan, 1977
Historic Structure Report Drawings, Carper

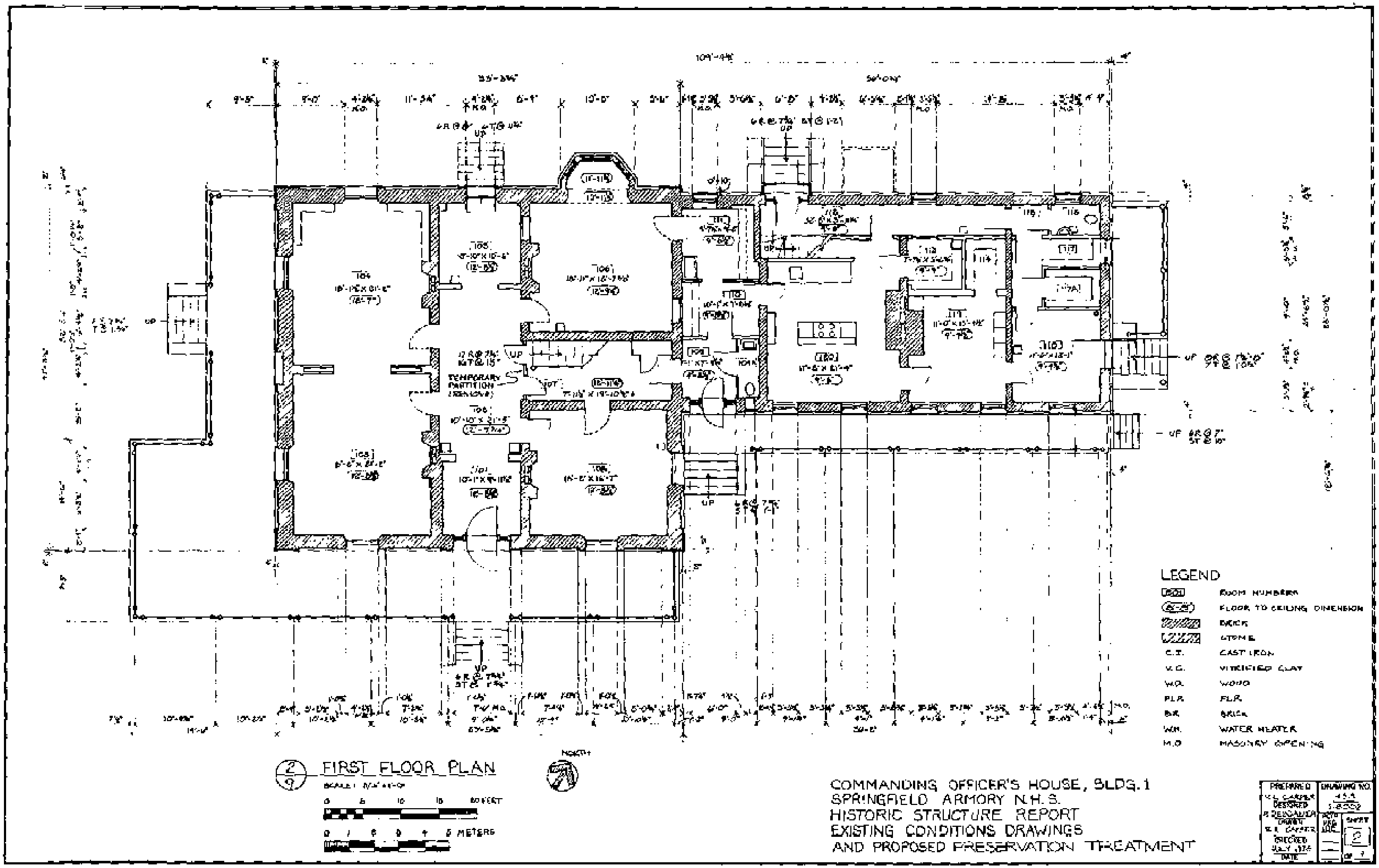
1977



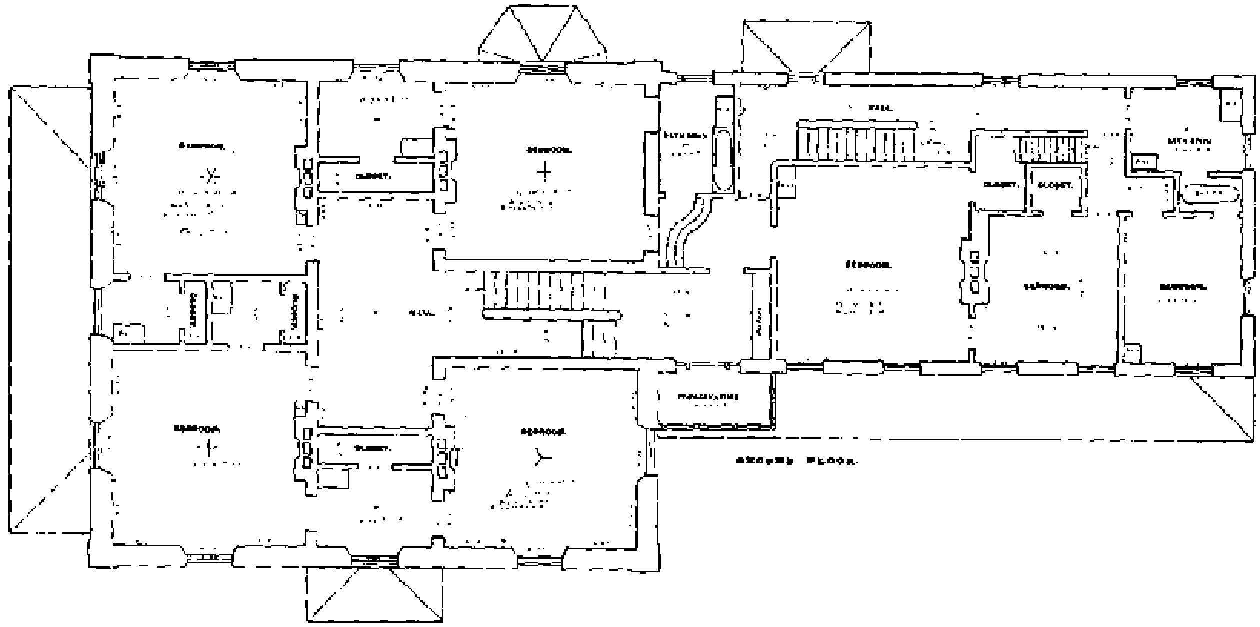
1876

Illustration 41
C. O.'s House, First Floor Plan, 1876
Officers' Quarters at the Arsenal and Armory, GPO, 1876

1876



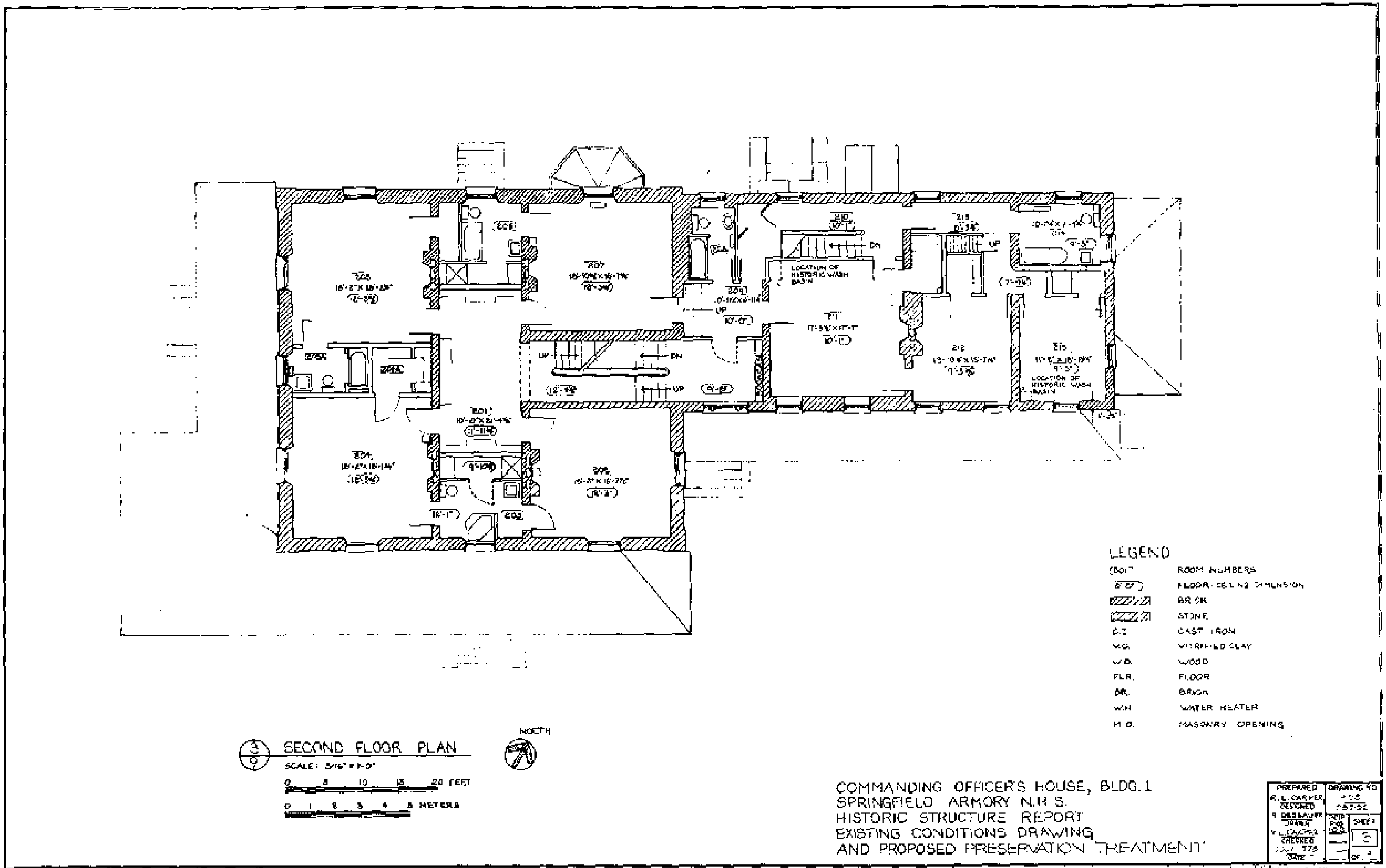
1977 Illustration 42
C. O.'s House, First Floor Plan, 1977
Historic Structure Report Drawings, Carper **1977**



1876

Illustration 43
C. O.'s House, Second Floor Plan, 1876
Officers' Quarters at the Arsenal and Armory, GPO, 1876

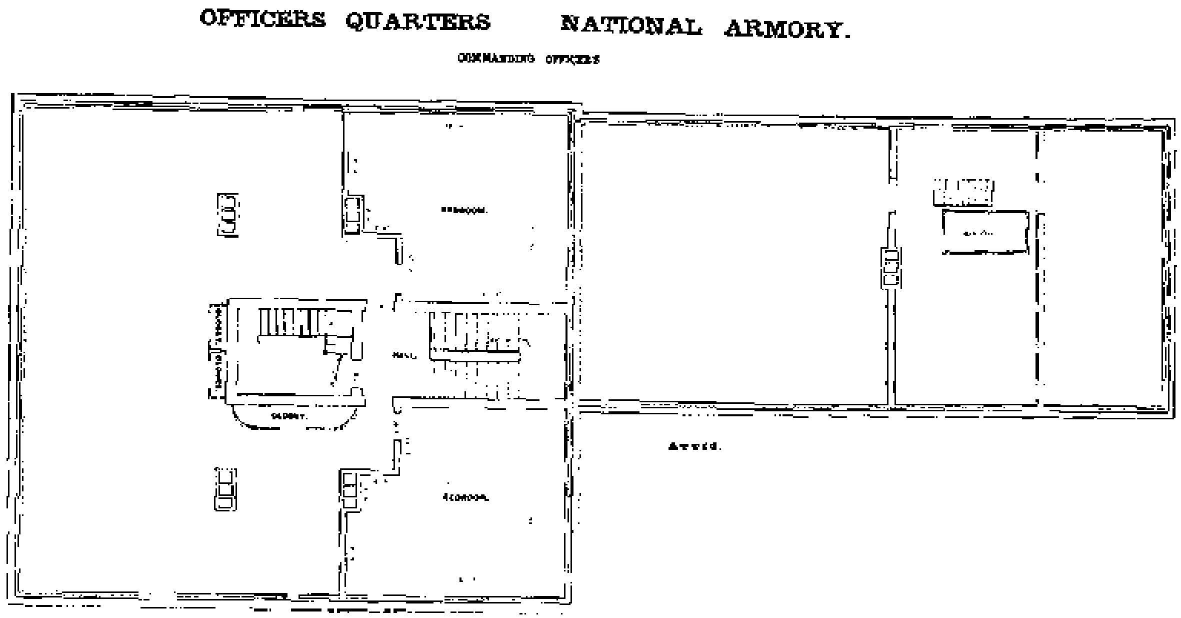
1876



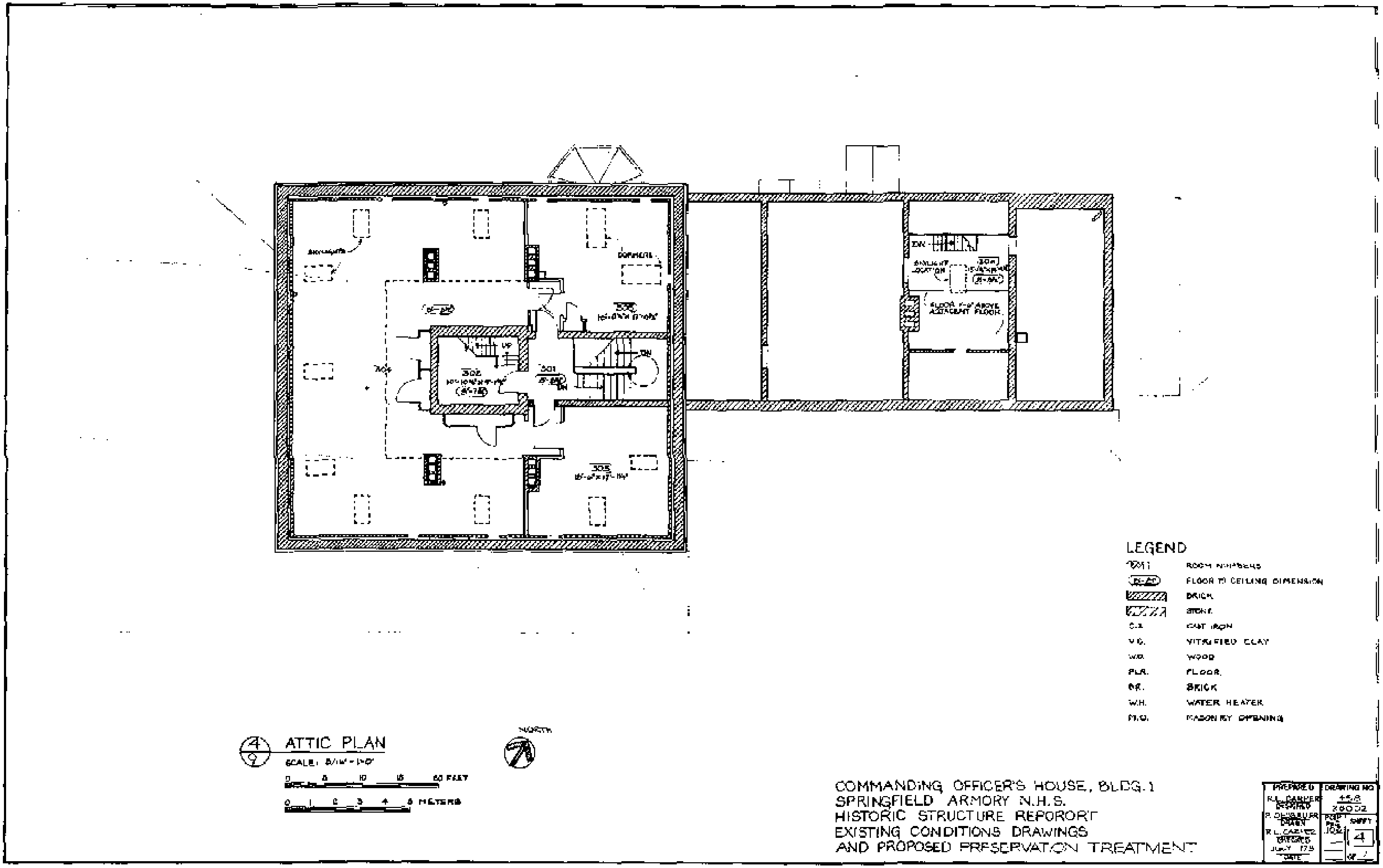
1977

Illustration 44
C. O.'s House, Second Floor Plan, 1977
Historic Structure Report Drawings, Carper

1977



1876 Illustration 45
C. O.'s House, Attic Floor Plan, 1876
Officers' Quarters at the Arsenal and Armory, GPO, 1876 1876



1977

Illustration 46
C. O.'s House, Attic Floor Plan, 1977
Historic Structure Report Drawings, Carper

1977

N.D.

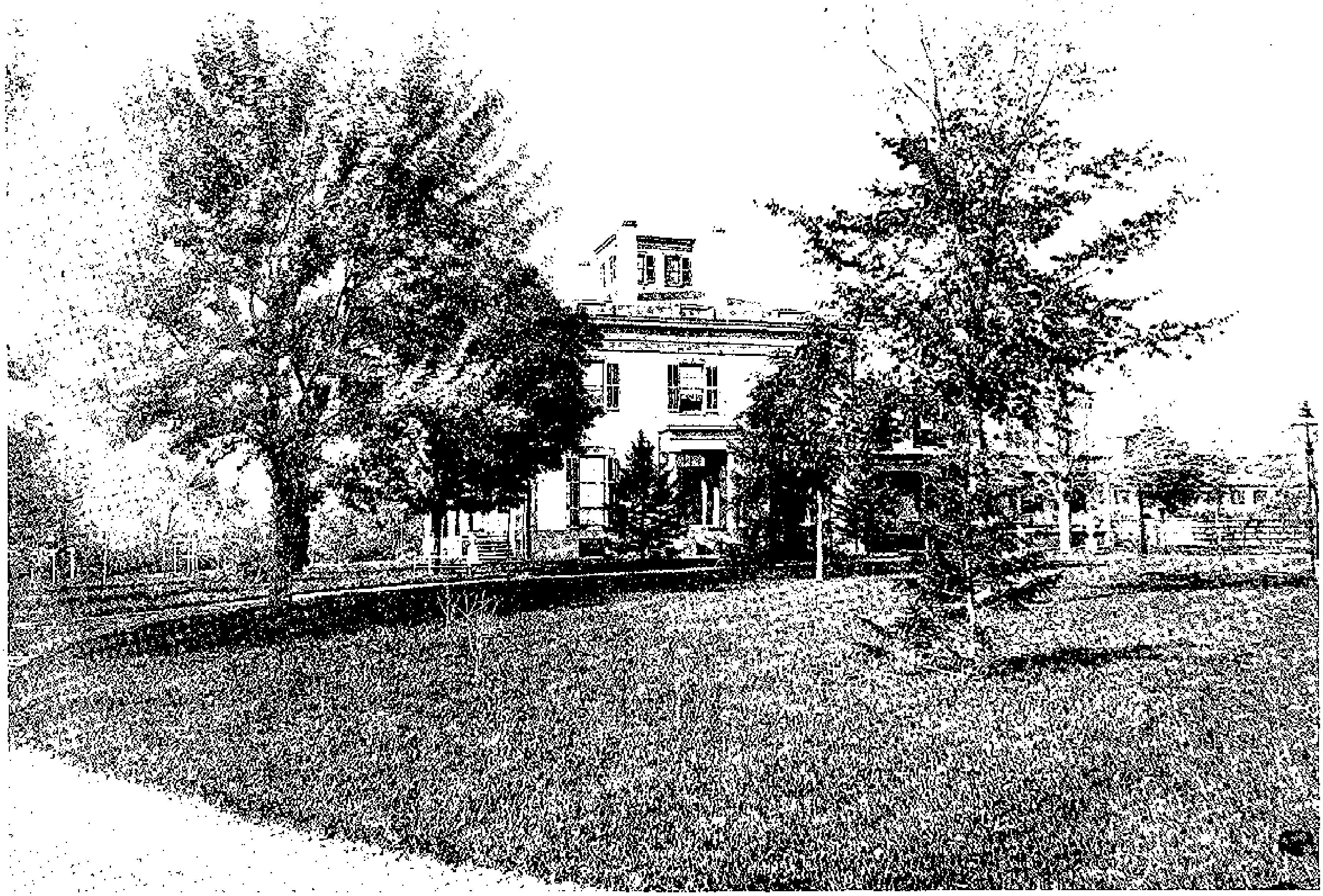
Illustration 47
C. O.'s House, South Elevation
U. S. Armory, Installation Facilities Office, NPS Park Files

N.D.

N.D.

Illustration 48
C. O.'s House, West and East Elevations
U. S. Armory, Installation Facilities Office, NPS Park Files

N.D.



c.1880 -1884

Illustration 49
C. O.'s House, View from South
NPS Park Files

c.1880 -1884

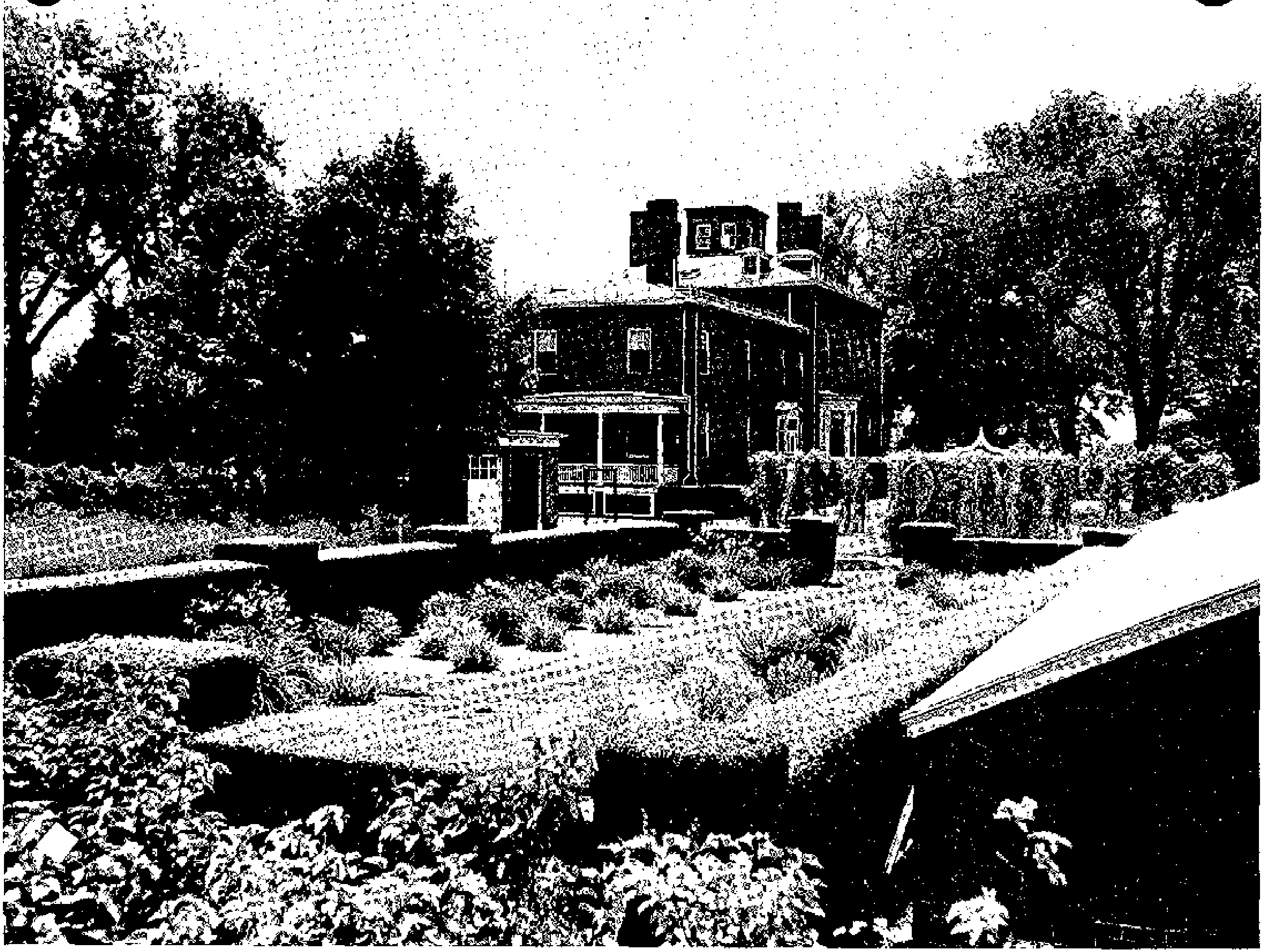
c.1900
-1937

Illustration 50
C. O.'s House, Front Steps
NPS Park Files

c.1900
-1937

Illustration 51
C. O.'s House, View from Southwest
NPS Evaluation Report, 1967

1967 1967



c.1937 -1958

Illustration 52
Building 1, View from Northeast
NPS Park Files

c.1937 -1958

1900 Illustration 53
C. O.'s House, Room 102, Entry Hall, View from Room 101
NPS Park Files 1900

1900 Illustration 54
C. O.'s House, Room 104, Parlor,
NPS Park Files

1900

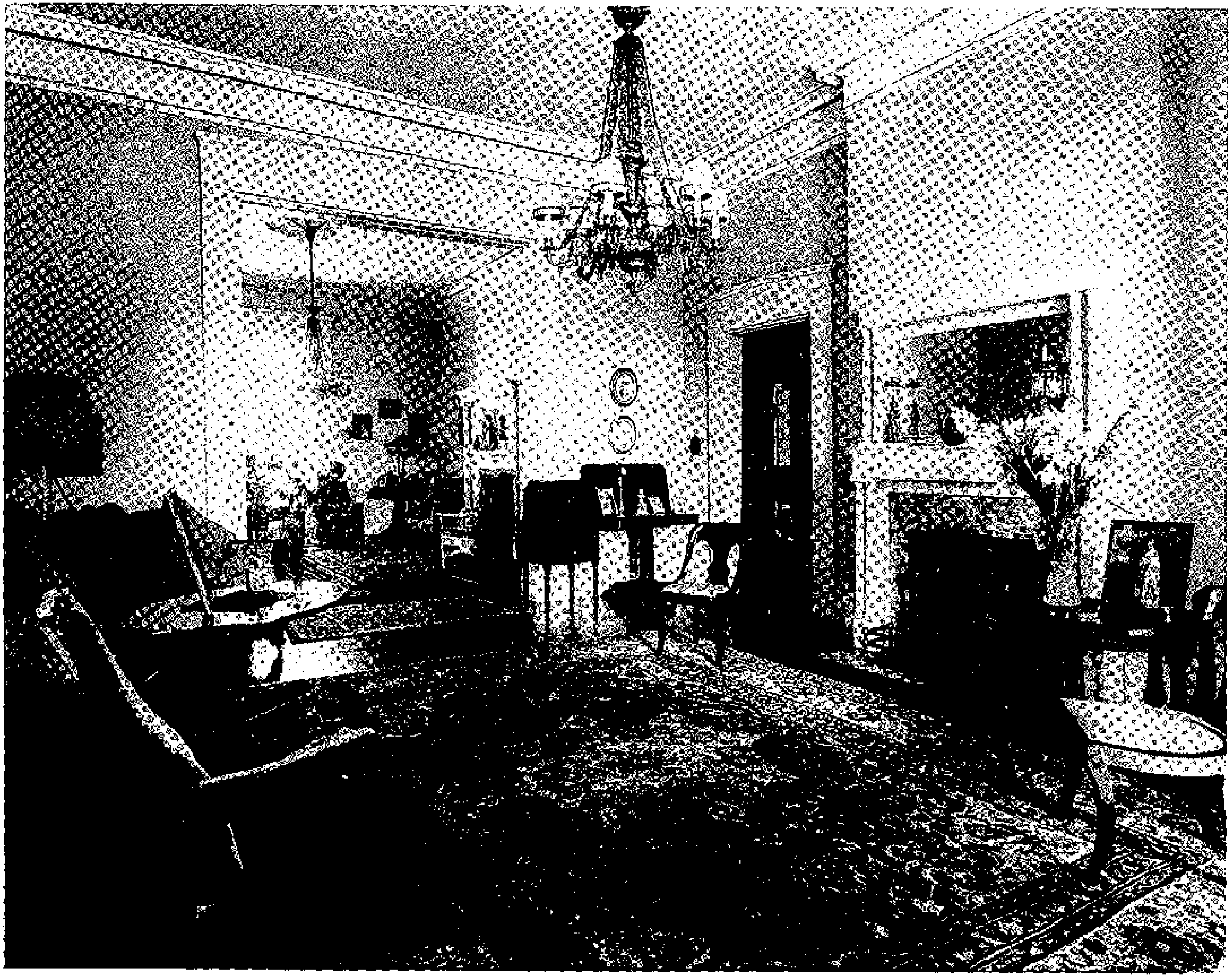


Illustration 55
C. O.'s House, Room 103, Parlor, Room 104 Beyond
NPS Park Files

1900

Illustration 56
C. O.'s House, Room 108, Library, View from Northwest
NPS Park Files

1900

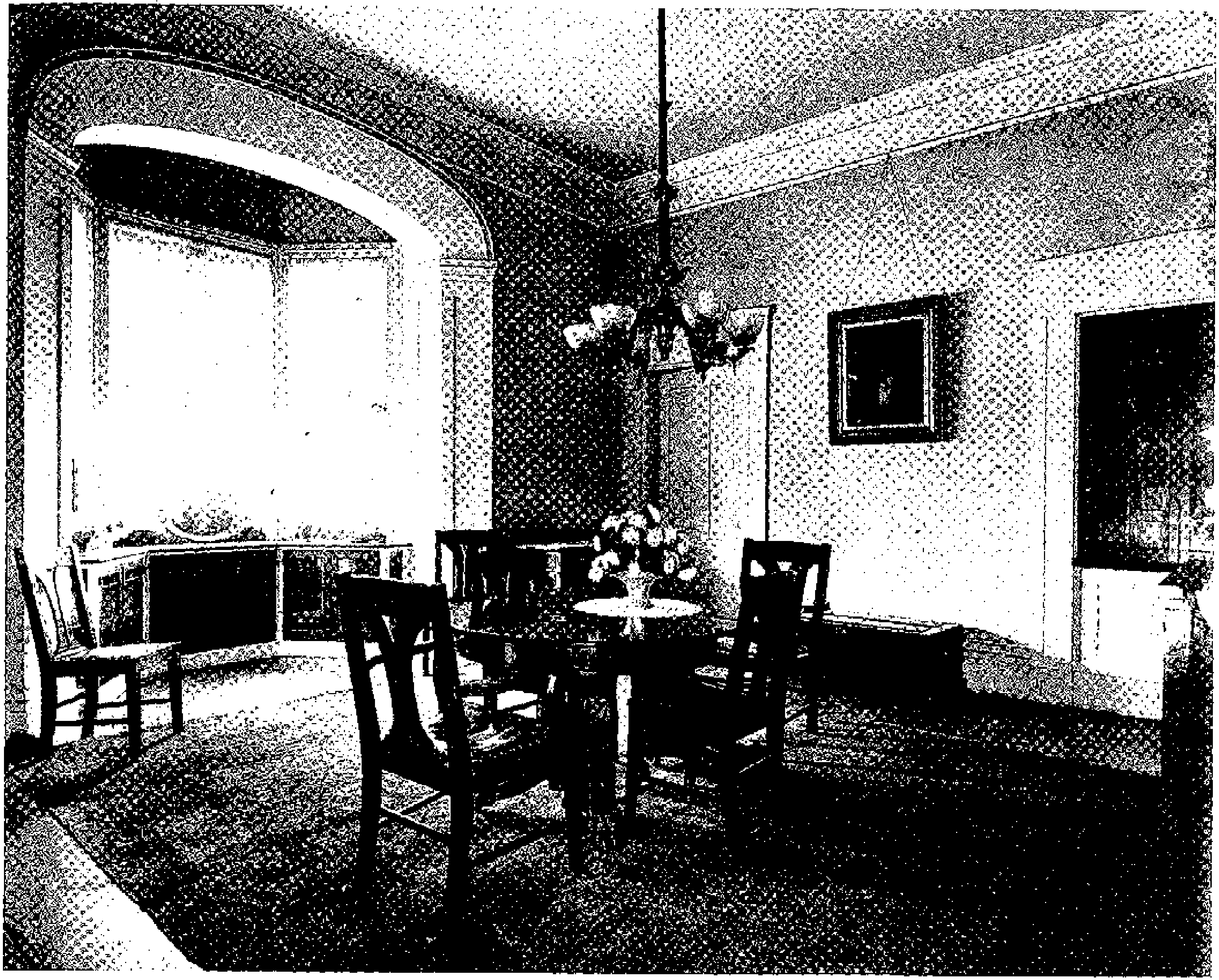


Illustration 57
C. O.'s House, Room 106, Dining Room, View from Room 102
NPS Park Files

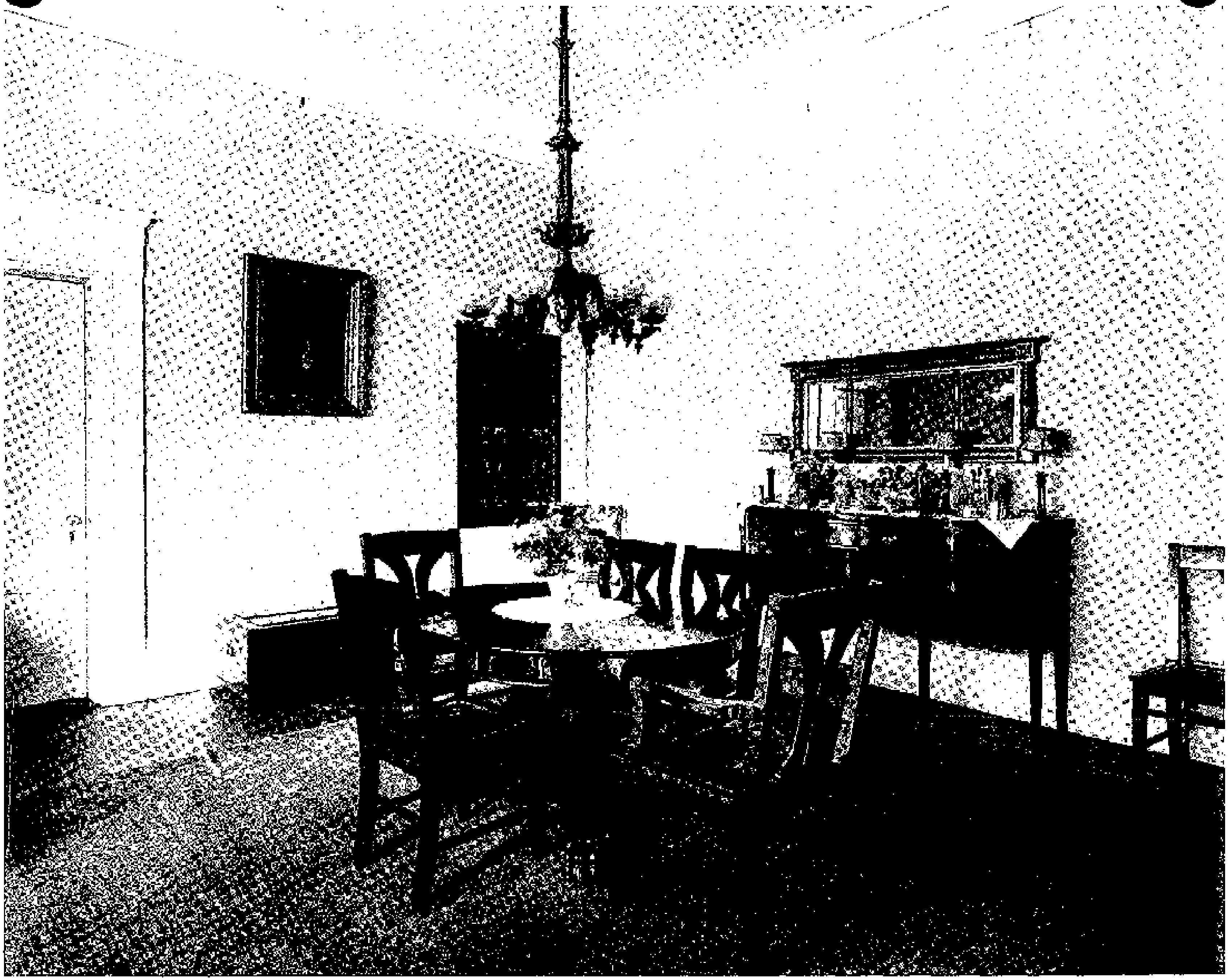


Illustration 58
C. O.'s House, Room 106, Dining Room, View from Northwest
NPS Park Files

1900 1900

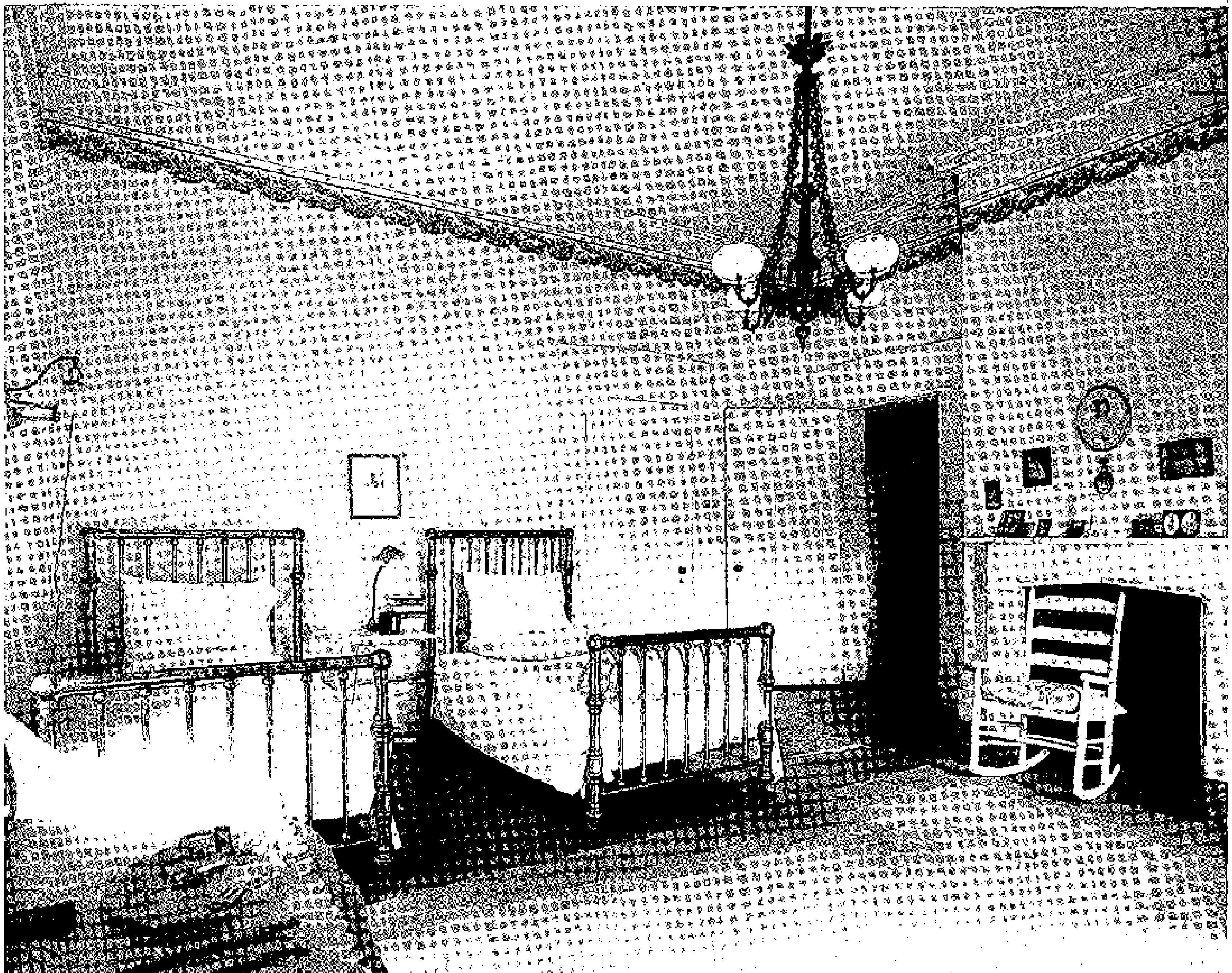


Illustration 59
C. O.'s House, Room 204, Bedroom, View from Southwest
NPS Park Files

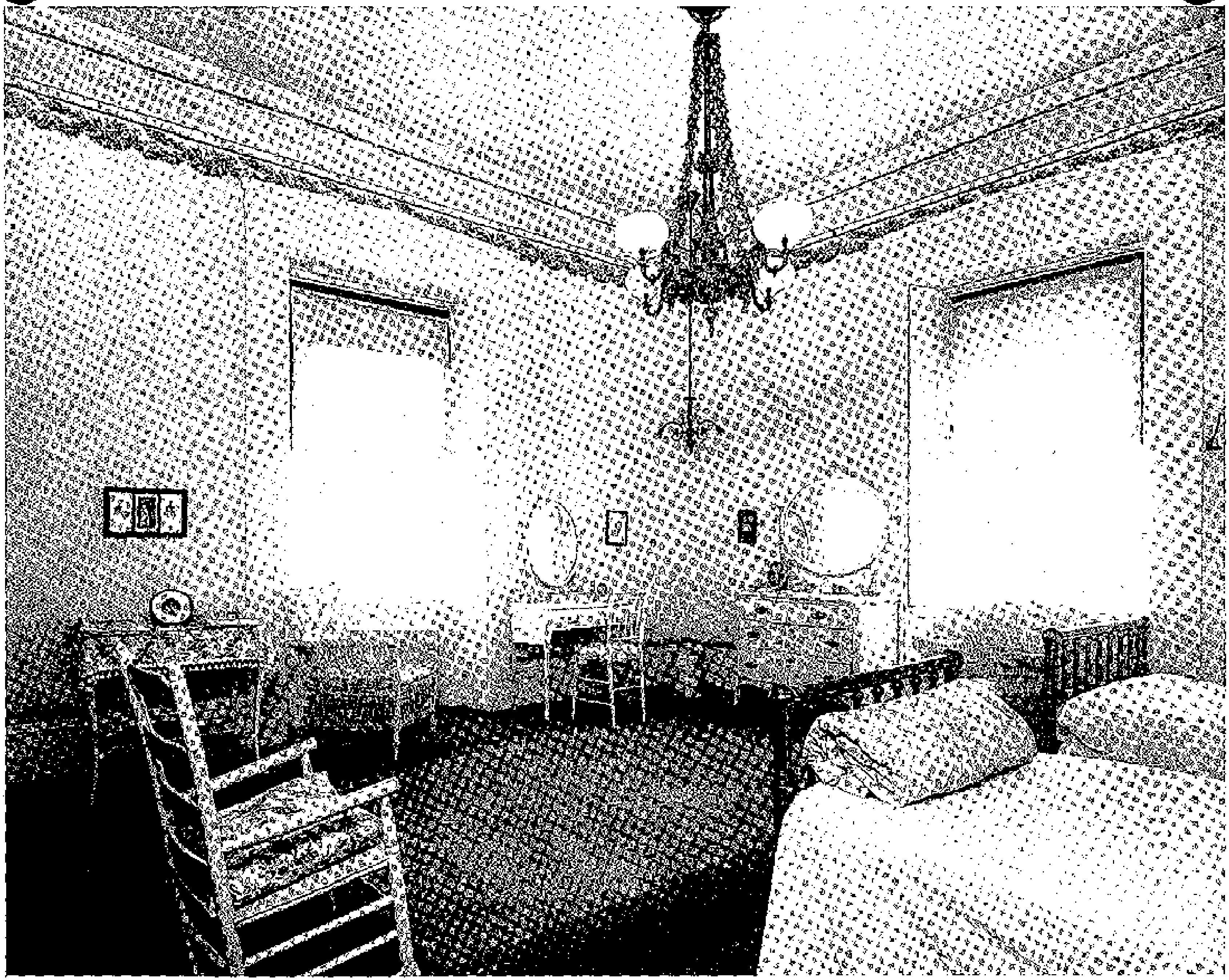


Illustration 60
C. O.'s House, Room 204, Bedroom, View from Northeast
NPS Park Files

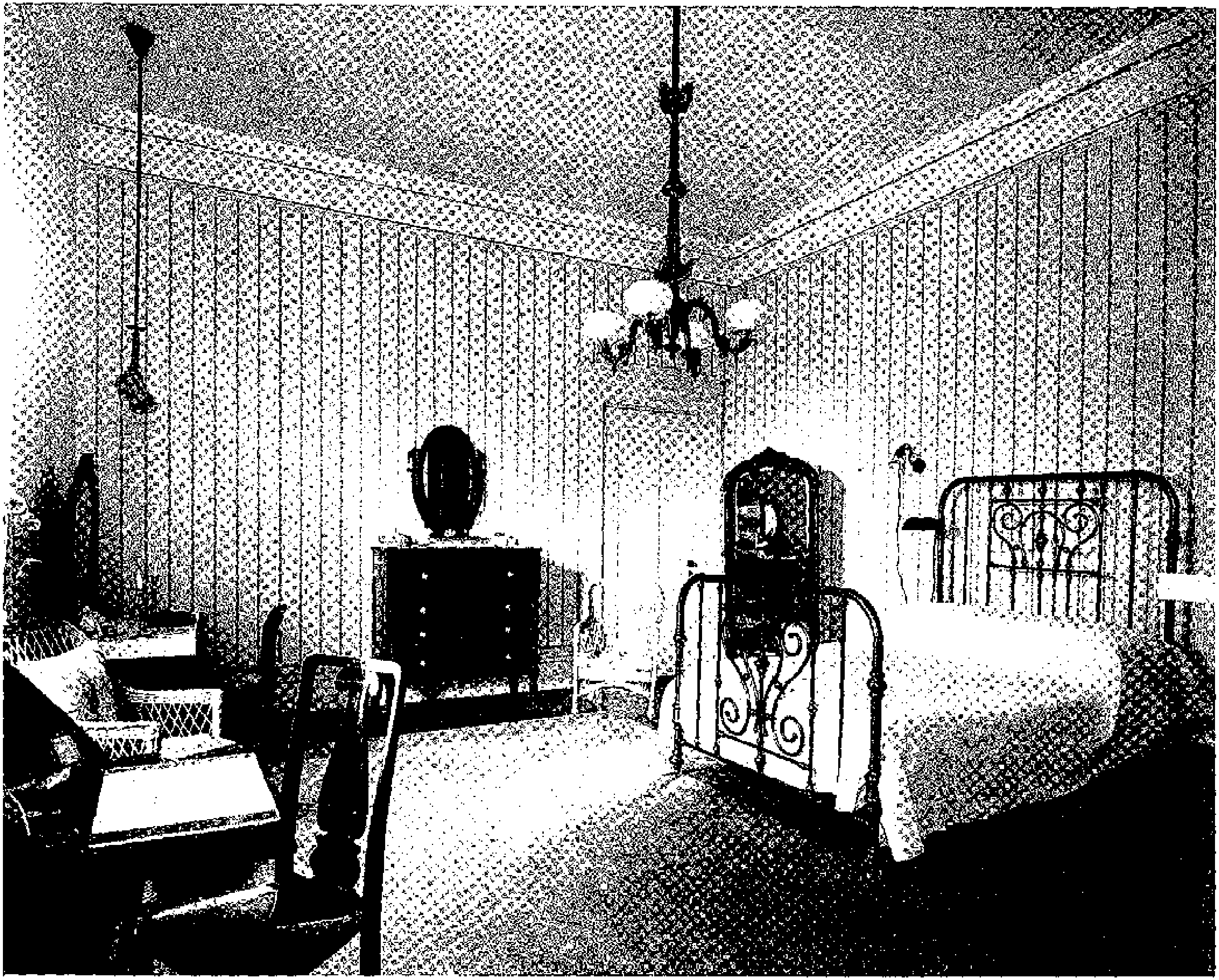


Illustration 61
C. O.'s House, Room 207, Bedroom, View from West
NPS Park Files

1900

Illustration 62
C. O.'s House
View from South

1976

NPS Photo, DSC

Illustration 63
C. O.'s House
View from South

1976

NPS Photo, DSC

Illustration 64
C. O.'s House
View from East

1976

NPS Photo, DSC

Illustration 65
C. O.'s House
View from West

1978

NPS Photo, DSC

Illustration 66
C. O.'s House
View from West

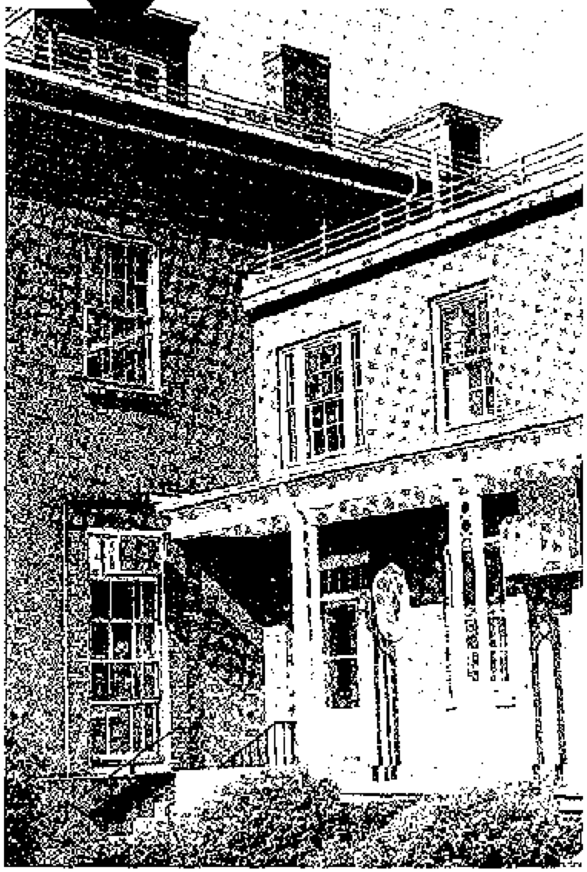
1977

NPS Photo, DSC

Illustration 67
C. O.'s House
View from Northeast
Note: Top of rose arbor to right of photograph

1976

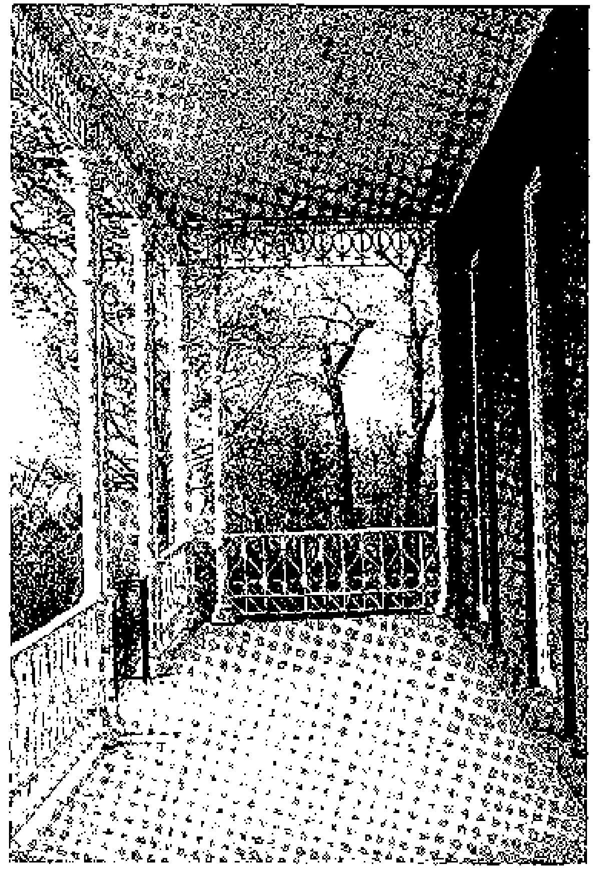
NPS Photo, DSC



1977

Illustration 68
C. O.'s House
View from East, Wing Entrance

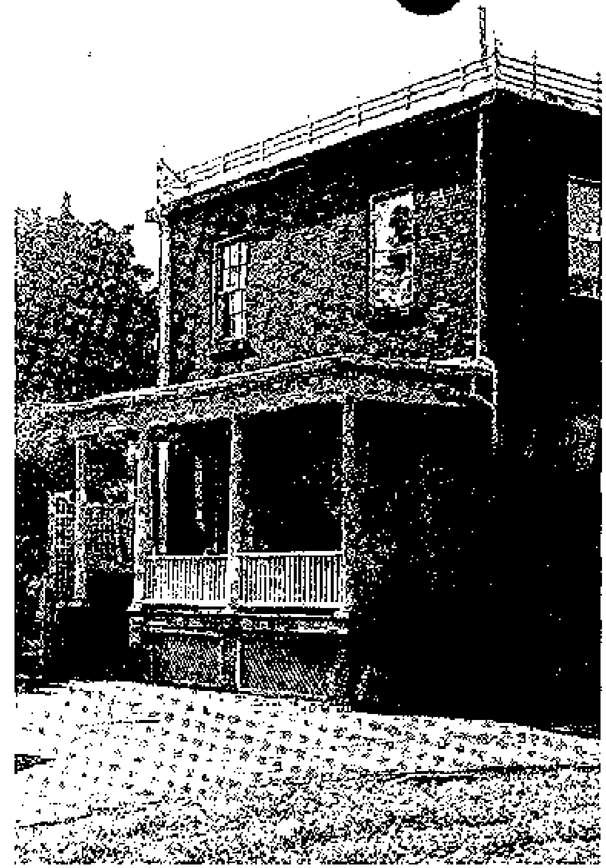
NPS Photo, DSC



1978

Illustration 69
C. O.'s House
West Porch

NPS Photo, DSC



1978

Illustration 70
C. O.'s House
East Wing Porch

NPS Photo, DSC

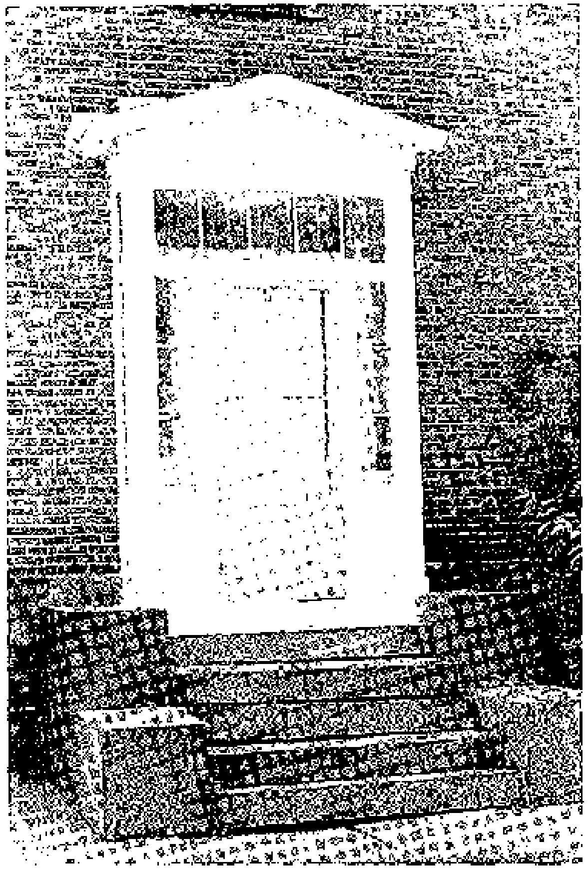


Illustration 71 **1977**
C. O.'s House
North, Wing Entrance

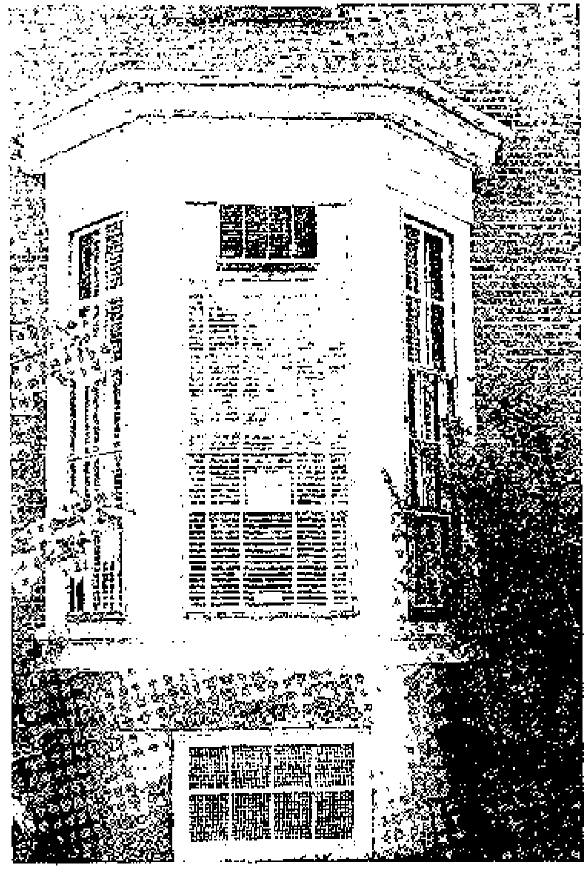


Illustration 72 **1977**
C. O.'s House
Bay Window, North Elevation

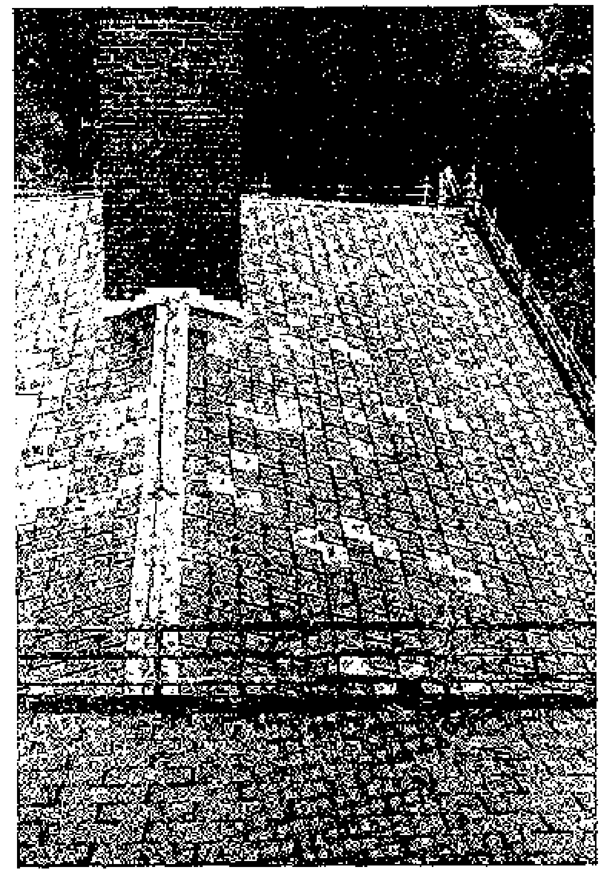


Illustration 73 **1977**
C. O.'s House
Wing Roof from Main House
Note: Light-colored slates indicate repairs

NPS Photo, DSC

NPS Photo, DSC

NPS Photo, DSC

Illustration 74 **1977**
C. O.'s House
Wing Roof and Chimney
Main House Roof and Skylight

Illustration 75 **1977**
C. O.'s House
Cupola

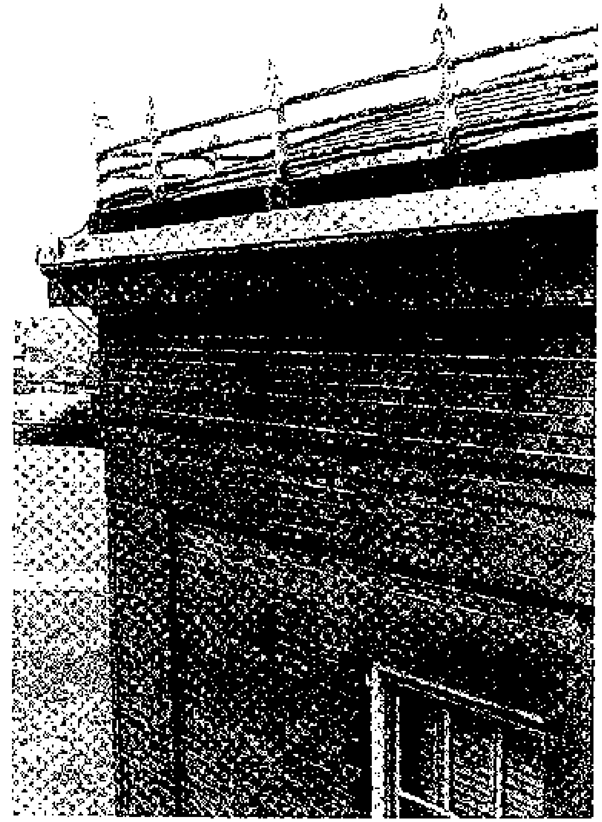


Illustration 76 **1977**
C. O.'s House
Southeast Corner of Main House
From Wing Roof

NPS Photo, DSC

NPS Photo, DSC

NPS Photo, DSC

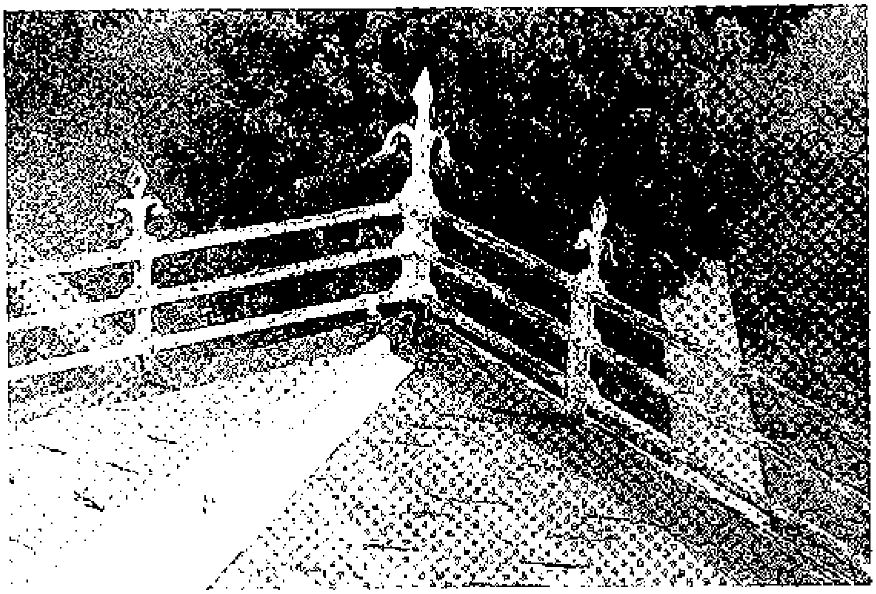


Illustration 77
C. O.'s House
Snowrail, Southeast Corner of
Main House

1977

NPS Photo, DSC

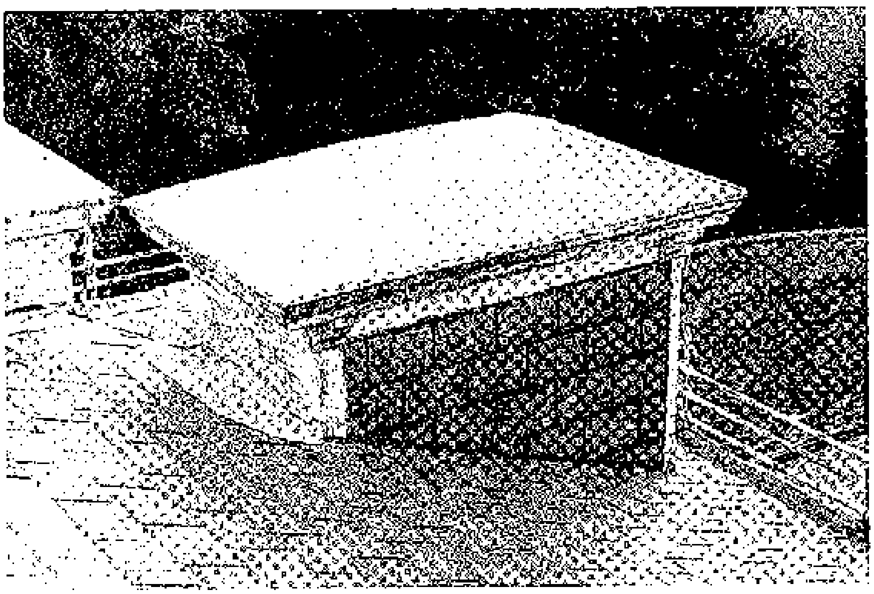


Illustration 78
C. O.'s House
Dormer, Northeast Corner of
Main House

1977

NPS Photo, DSC

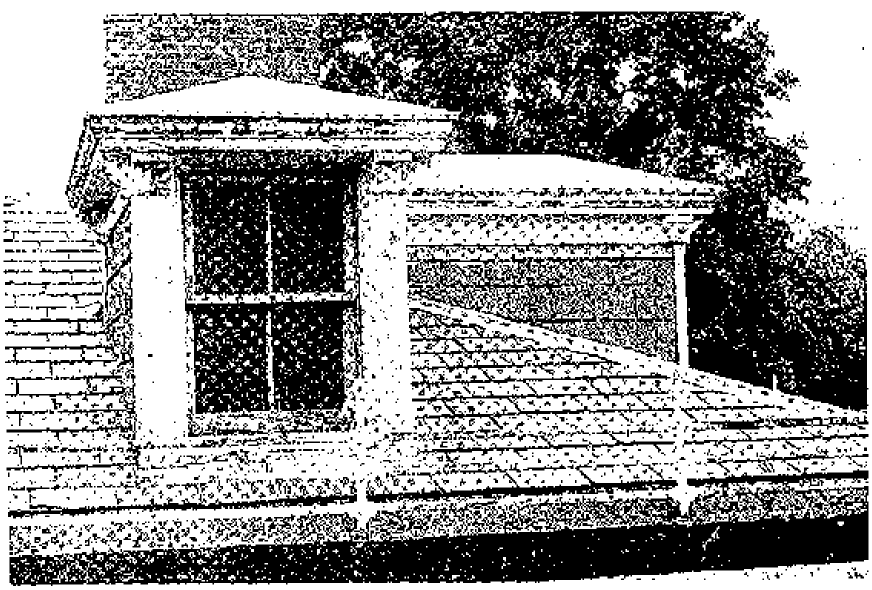
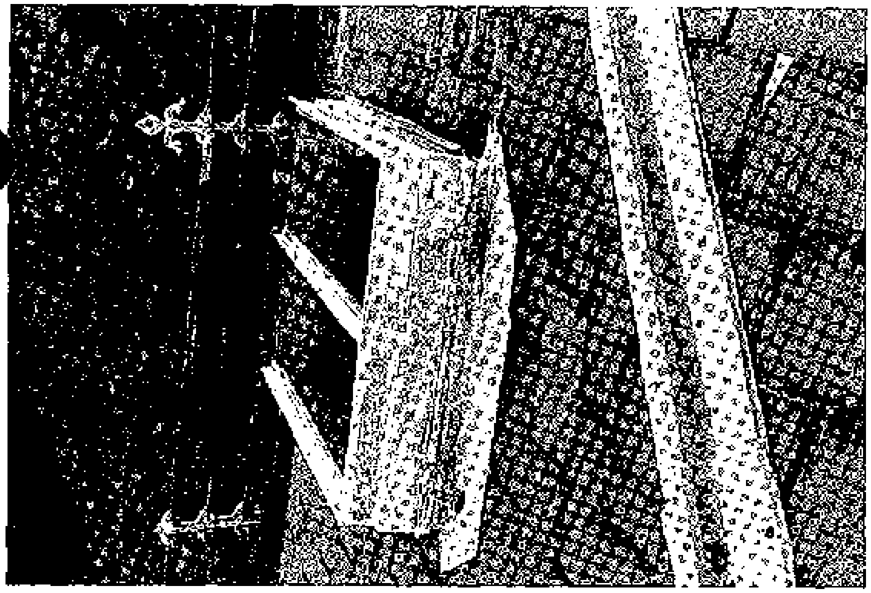


Illustration 79
C. O.'s House
Dormer, Northeast Corner of
Main House

1977

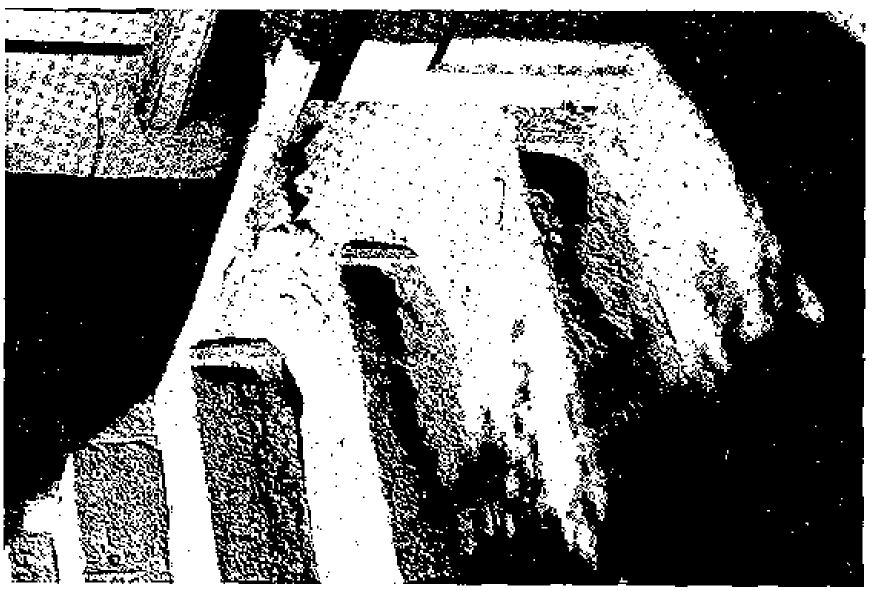
NPS Photo, DSC



1977

Illustration 82
C. O.'s House
Skylight, Northwest Corner of
Main House

NPS Photo, DSC



1978

Illustration 81
C. O.'s House
East Porch Steps
Note: Erosion of Stone

NPS Photo, DSC

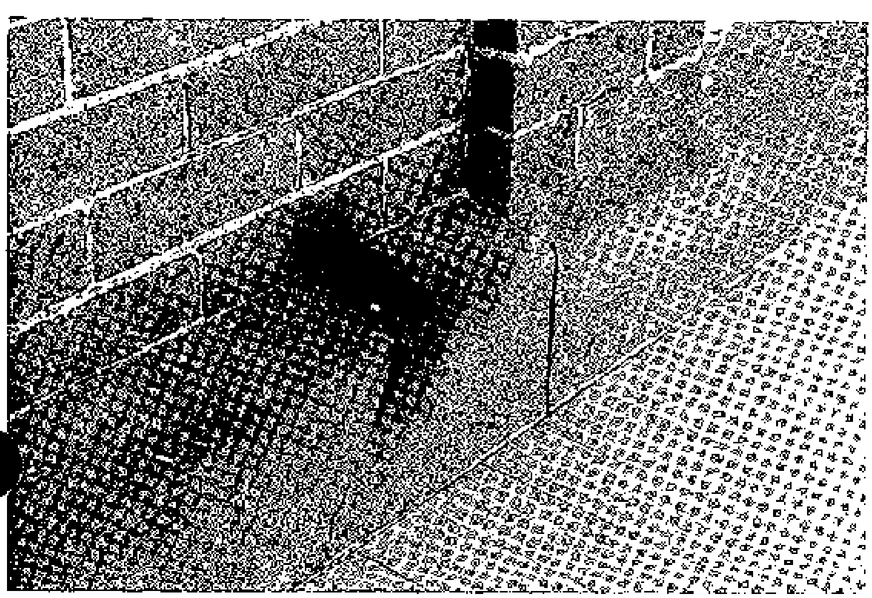


Illustration 80
C. O.'s House
Shutter Dog
Note: Cracked Stone

1978

NPS Photo, DSC

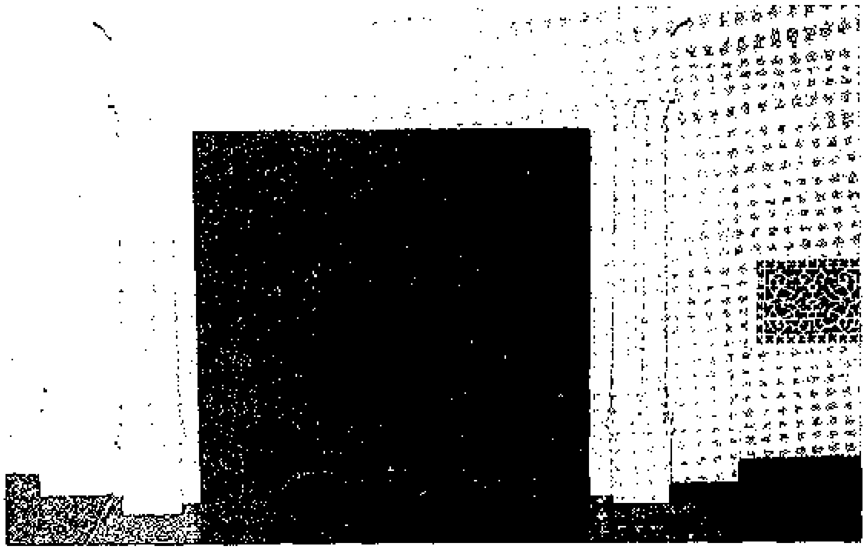


Illustration 83
C. O.'s House, Room 108
Fireplace

NPS Photo, DSC

1977

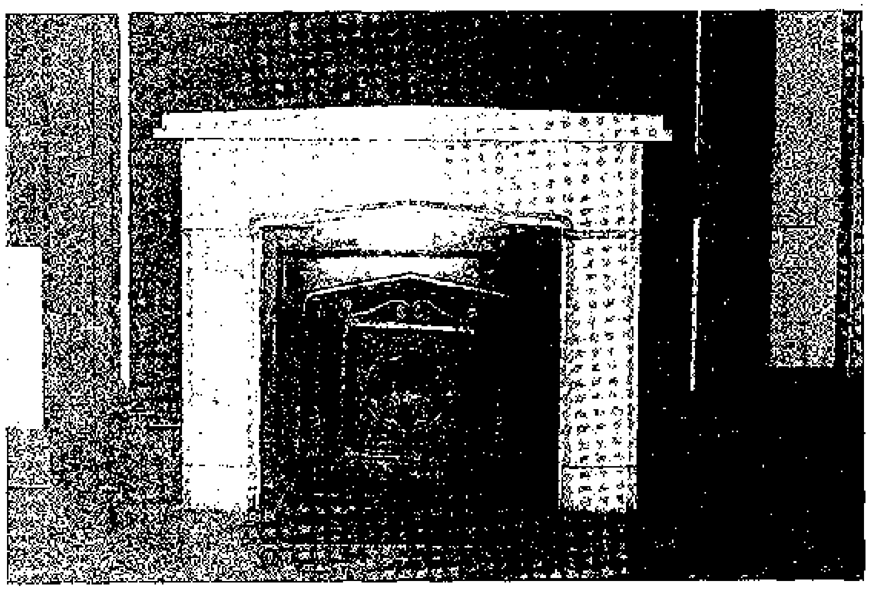


Illustration 84
C. O.'s House, Room 202
Fireplace and Insert

NPS Photo, DSC

1977

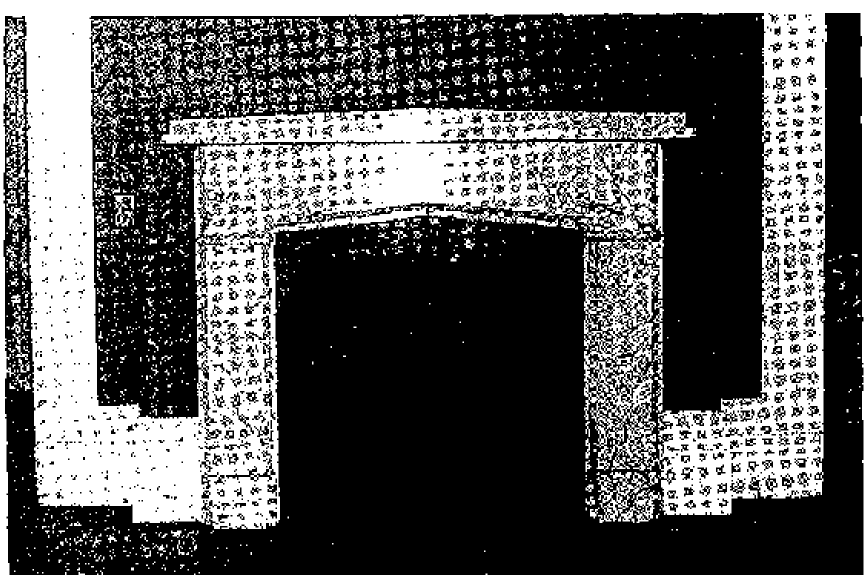


Illustration 85
C. O.'s House, Room 204
Fireplace

NPS Photo, DSC

1977

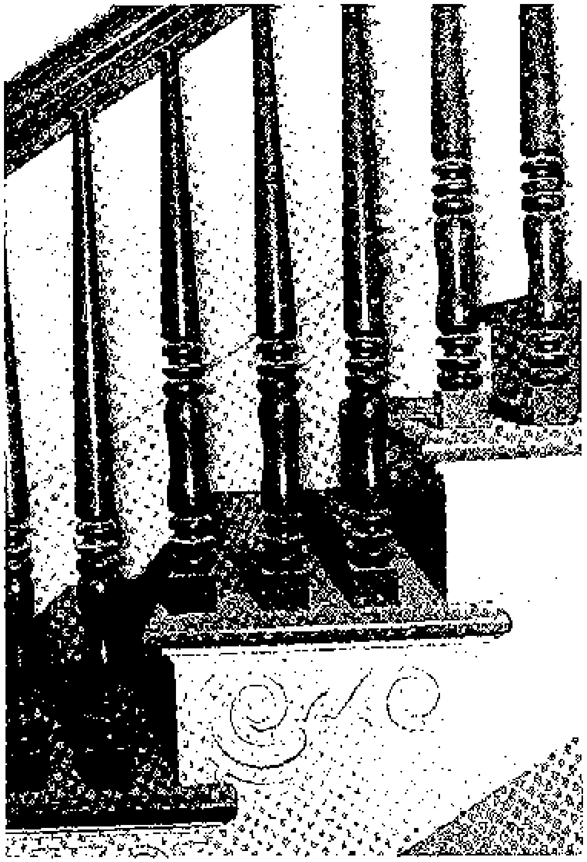


Illustration 86
C. O.'s House
Detail Mainstair

1982

NPS Photo, DSC

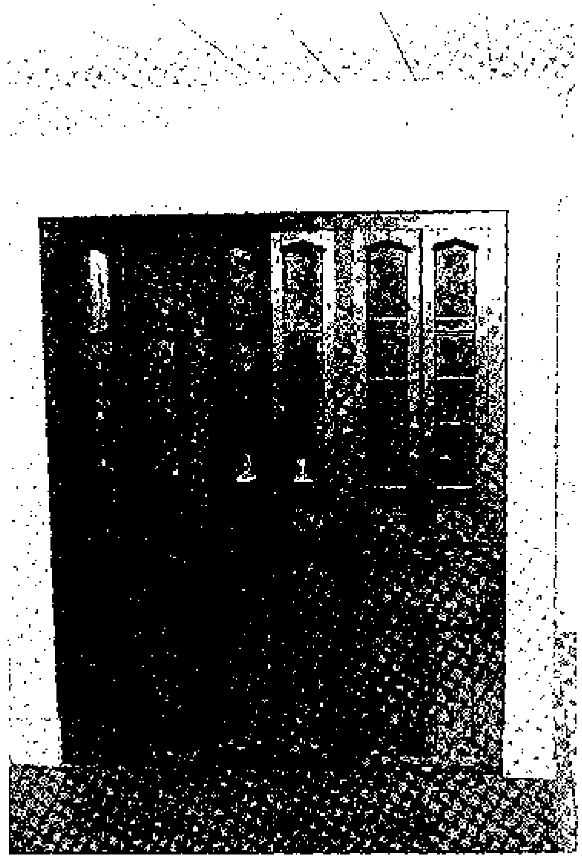


Illustration 87
C. O.'s House
Bookcase, Second Floor Stairwell

1977

NPS Photo, DSC

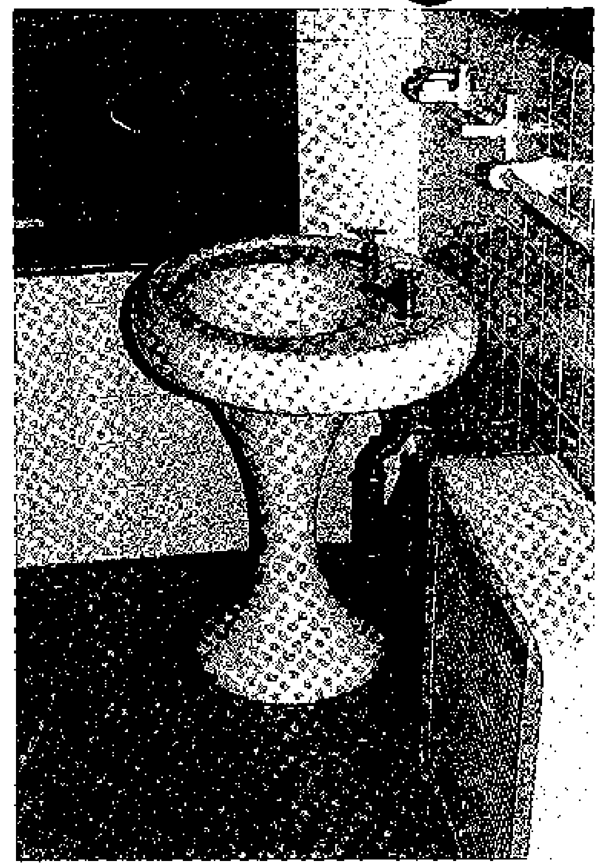


Illustration 88
C. O.'s House, Room 208
Lavatory

1977

NPS Photo, DSC

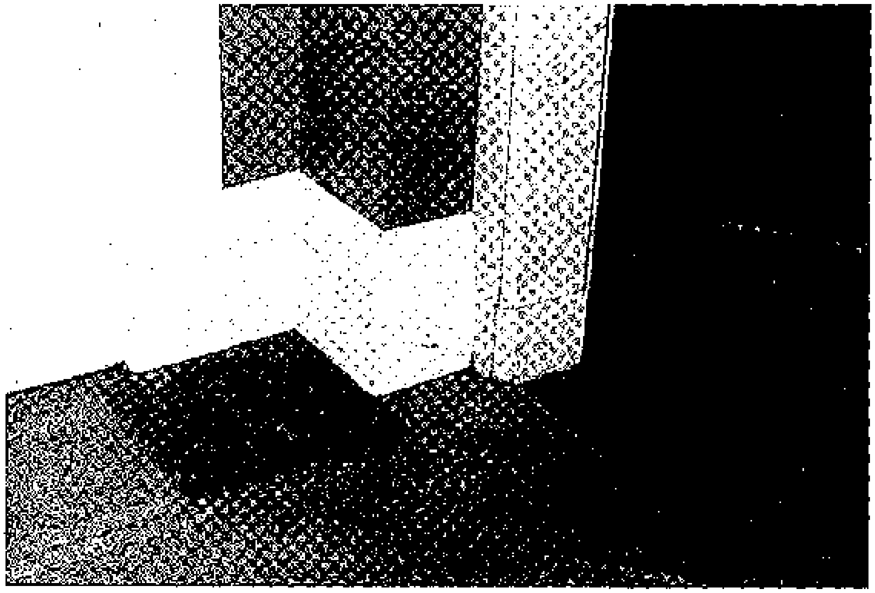


Illustration 89 **1977**
C. O.'s House, Room 204
Gravity Heating System Register

NPS Photo, DSC

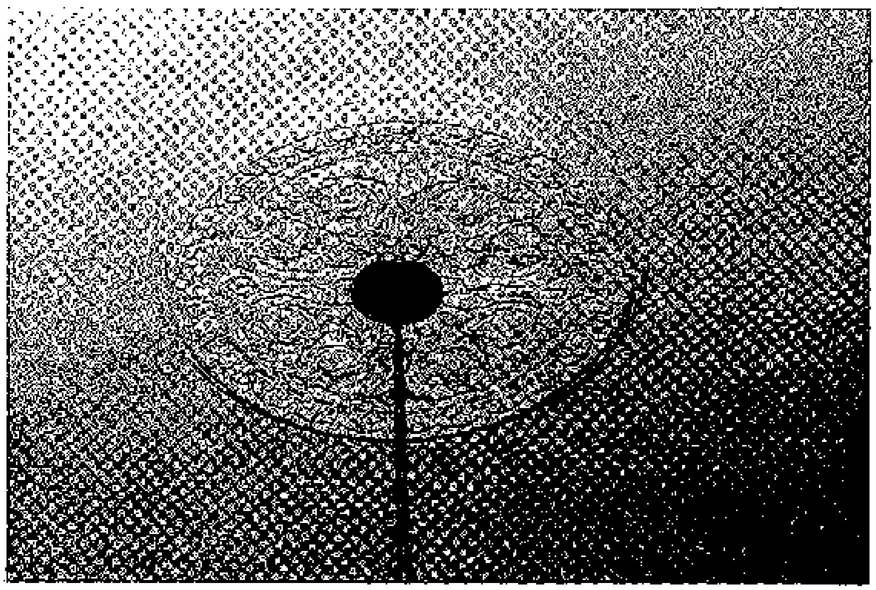


Illustration 90 **1977**
C. O.'s House, Room 106
Ceiling Medallion for Lighting
Fixture

NPS Photo, DSC

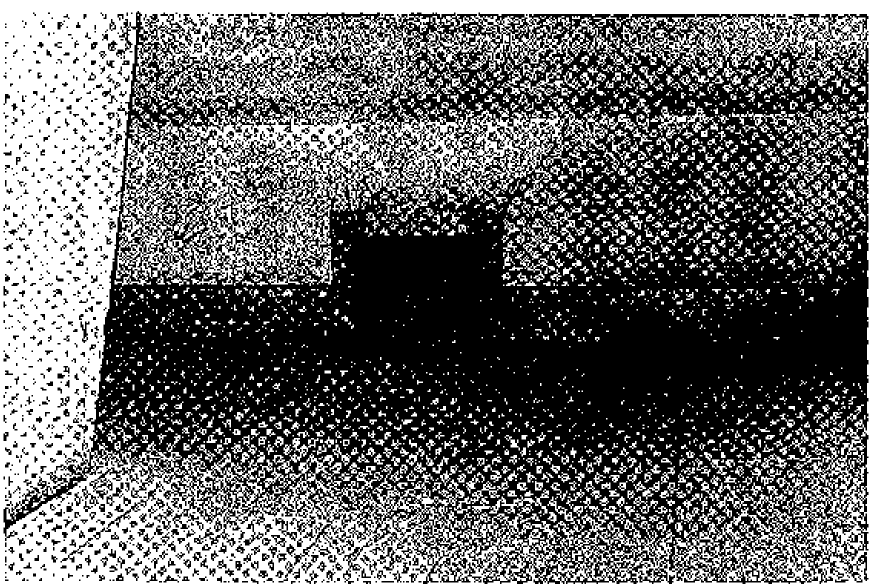


Illustration 91 **1978**
C. O.'s House, Attic
Door Vent to Cavity Wall

NPS Photo, DSC

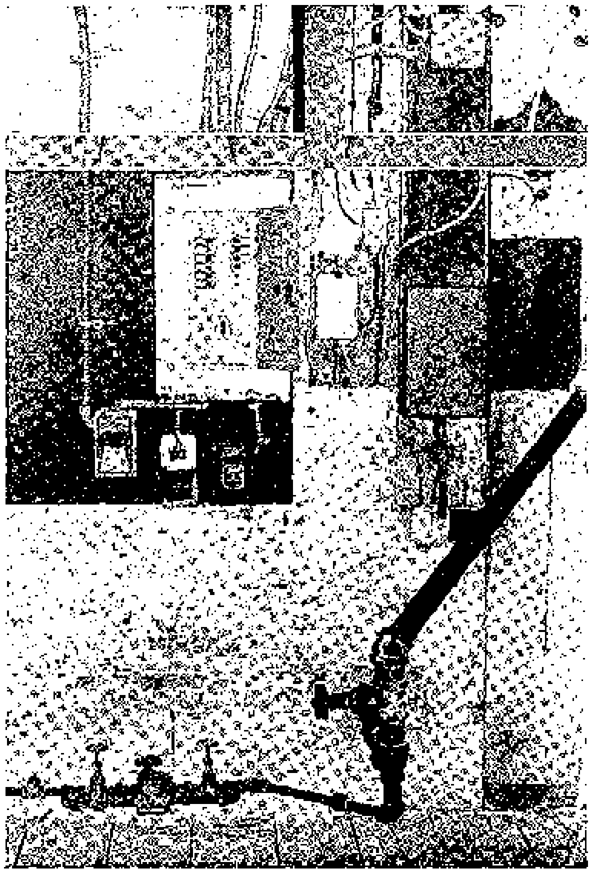


Illustration 92 **1976**
C. O.'s House, Room B07
Electrical Panels and Steam Lines

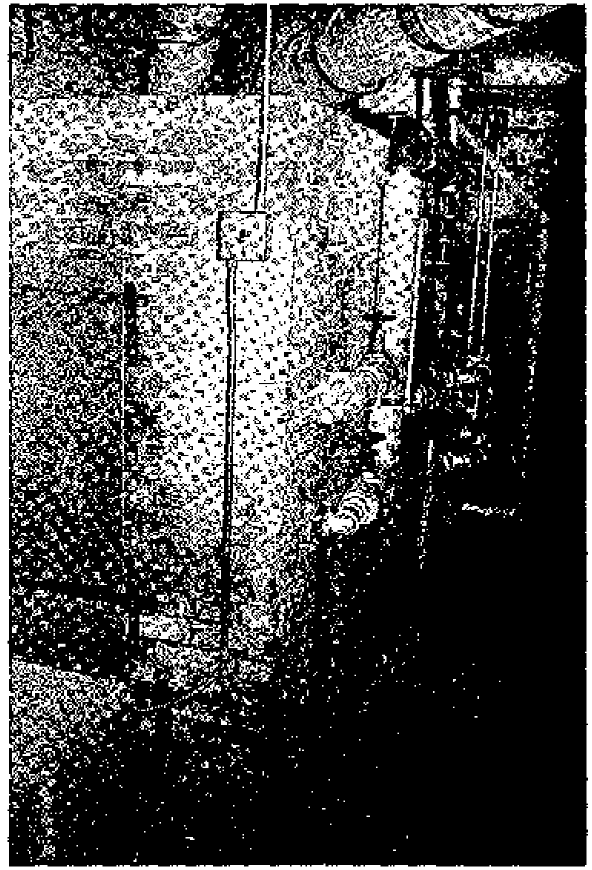


Illustration 93 **1976**
C. O.'s House, Room B10
Heating Chamber with Steam Piping

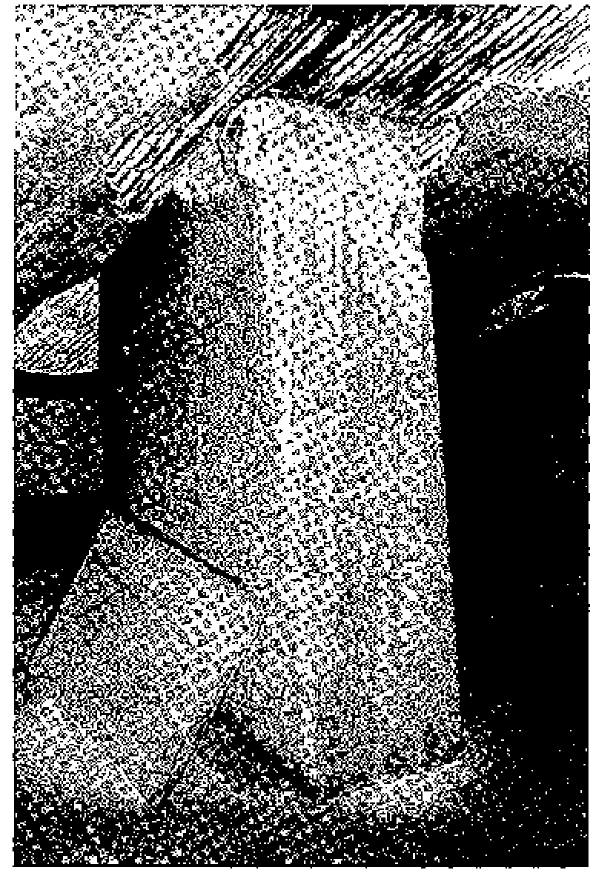


Illustration 94 **1982**
C. O.'s House, Room 304, Attic
Northwest Chimney
Plaster damaged due to deteriorated flashing

NPS Photo, DSC

NPS Photo, DSC

NPS Photo, DSC

MASTER ARMORER'S HOUSE - BUILDING 10

IV. THE MASTER ARMORER'S HOUSE, BUILDING 10

A. General Description and Evolution

The construction of the Master Armorer's and Paymaster's Houses was under the tenure of Roswell Lee. These were both constructed in 1833, the former northwest and the later southeast of the site of the Main Arsenal; which was not yet in existence.[1]

The Master Armorer's House may have had water service installed in 1852,[2] and during this period the house was painted like the other buildings at the Armory. A c. 1880 photograph shows the house painted yellow ochre with red-brown trim like the Main Arsenal and the Commanding Officer's House.[3] By 1882 the Master Armorer's House was moved.[4] All three sections of the house were moved to the north about 300 feet, rotated 180 degrees and placed on the opposite side of the street.

The Paymaster's House was moved to the north side of Armory Square in 1895.[5] By 1902, the Master Armorer's House was being used as

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1. Albright, John, Historic Structure Report, Historical Data and Historical Base Map, Springfield Armory National Historic Site, Massachusetts, National Park Service, Denver Service Center, Denver, Colorado, May 1978, pp. 16-17.

In the collection at the park, this date was verified in Benet, Brig. Gen. Stephen V., A Collection of Annual Reports and Other Important Papers Relating to the Ordnance Department, Vol. I, (1812 to 1844), Washington, Government Printing Office, 1878, p. 528: "Erection of two new dwelling houses at the national armory at Springfield, Mass., for the use of the master-armorer and paymaster. 4 Stat., 641, March 2, 1833, $7,000."

2. Ibid., pp. 39-40.

3. Ibid., p. 68.

4. Ibid., p. 67; Map 11, p. 69.

5. Ibid., pp. 75-76.

a hospital, and city water was installed to the building that year.[6] But by 1899, the house had lost its rear section.[7]

In 1932, the house still had its four tall chimneys of the front section one for what had become the rear section, and it sill had its shutters.[8] It is difficult to be sure from the 1932 photograph, but it appears that the paint had been removed from the brickwork. The year 1937 saw WPA remodeling of the house.[9] It was probably at this time that the four front chimneys were removed, fireplaces blocked, and some of the interior modifications and refinishing done. The date of the second floor addition to the side porch is not known, but was probably not later than 1937. The entrance portico had been enclosed by 1932. A bootscraper still exists from the time when it was an open portico.

The positions of Commanding Officer, Paymaster, and Master Armorer were the highest positions at the Armory. Hence their quarters were placed in a position of prominence at the southwest end of Armory Square, with the Paymaster's and Master Armorer's residences flanking the Main Arsenal.

This Federal period, two-story brick house was detailed in the Greek Revival mode. The original house had three rectangular sections of progressively decreasing volume placed along its longitudinal axis from front to rear. The third rear section no longer exists. The gable-roofed front section is detailed with a full pediment at the front facade, within which is an attic window formed with a three-centered arch. The front facade is symmetrical except for the entry portico which is the left

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6. Albright, p. 76.

7. Ibid., Map 12, p. 77.

8. See Illustration 101.

9. Albright, p. 83.

opening of the three of each floor. The symmetrical placement of the three windows of the second floor and two of the first floor is reflected in the right elevation, but here the four windows of each floor are not spaced uniformly. Window locations on other facades are less uniform. Windows are wood frame, double hung sash, and most are 6 over 6 light.

The front section of the house measures 33 feet 8 inches by 40 feet 8 inches, and the rear section 18 feet 7 inches by 30 feet 1 inch. These dimensions are below the stone water table. Above the water table, the building measurements are approximately 6 inches less than the above except that the length of the rear section is the same.

Roofing is slate and the wood eaves of the main section are adorned with a ball moulding. The second floor of the side porch is a later addition. Door and window changes occurred to accommodate porch and interior modifications.

The 1876 plans[10] reproduced in this report are of what was then Building 4, Officer's (Assistant's) Quarters. That house no longer exists. Based on physical evidence, Building 10 is almost an identical house and these plans are used for comparison of the existing elements to those of 1876. Most room use designations used in this report are from the 1876 plans.

Note that the 1876 plans indicate the locations of gas lighting fixtures. Some changes in the house probably occurred when the building was moved, (c. 1877-82), or about 1902 when it fell into use as a hospital, but many materials and finishes now visible probably date from 1937 when the house was remodeled--a WPA project. The windows with interior shutters which fold into jamb pockets are probably features which

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10. Ordnance Department, Plans of Officer's Quarters at the Arsenals and Armory, Government Printing Office, Washington, D. C., 1876; Military History Research Collection, Military History Institute, Carlisle Barracks, Carlisle, Pennsylvania. See Illustrations 95, 97, and 99.

have undergone the least change. The basic interior room arrangement, however, remains much as it was originally.

The front section of the first floor consists of an entry hall (on the left side as one faces the house), behind which is a library. Two parlors complete the remaining area. The present rear section of the house was originally a center unit containing the dining room and two pantries. From the front entry, circulation was directly through the library to the rear portions of the house, which had no hallways. The original dining room and pantries were converted to a rear entry, bedrooms, and a kitchen, probably in the 20th century. The front entry hall was also subdivided. These changes may have occurred in 1937 or even later.

The second floor front section of the house consisted of four bedrooms and interconnecting halls, which also gave access to the rear of the house. The floor level of the present rear section (originally the center section) is approximately 2 feet 3 inches lower than that of the front portion of the house. The stair to the attic is entered from the main hall.

The 1876 plan, which is for Building 4, indicated this portion of the second floor to have consisted of a storeroom, bath, hall, and bedroom. Whether this arrangement existed in Building 10 was not entirely determined. Two large rooms and a bath exist there now.

B. Existing Conditions - Exterior

1. Roofing

Although unlikely to be the original, the slate roofing is probably historically correct. The roof is in good condition, with occasional damaged slates.

2. Flashings, Gutters, and Downspouts

Except for the side porch and entrance portico, the gutters are built into the eaves of the roof. These will need thorough inspection and repair to eliminate any leakage, which is particularly important to prevent deterioration of the wood eaves and trim.

Some downspouts on the north side of the house are missing, others are deteriorated. These conditions cause flooding of the walls with water or splash onto the top of the stone water table, resulting in mortar erosion and the walls being penetrated with moisture.

3. Masonry

Above the stone water table, the original brickwork of the walls is in good condition, even though the hard smooth surface was removed when the building was sandblasted to remove the paint. This paint removal was probably done during the 1930s, possibly earlier. The sandblasting greatly increased the permeability of the brick walls, although they have withstood at least 40 years of weathering remarkably well.

The original brick walls are laid up in running bond with header courses each eighth course. Bricks are 2-1/8 inches by 3-3/4 inches by 7-3/4 inches, laid with 1/4 inch joints in lime mortar.

Below the red sandstone water table, the existing bricks were laid when the house was moved in the late 1870s or early 1880s. This brickwork is running bond with some header courses. The number of courses varies from nine to eleven above grade. Bricks are 2-1/4 inches by 3-3/4 inches by 7-1/2 inches to 8 inches, laid in lime mortar but pointed with several mixes of cement mortar. Brick bonding is poorly matched, coursing is irregular, headers are randomly set, and header courses are discontinuous. Mortar joints vary from 3/8 inch to 5/8 inch in thickness.

The projecting water table, window and door sills, and flat window and door lintels are red sandstone.[11] The water table projects 3

11. See Illustration 108.

inches from the foundation walls below and 6 inches from the walls above. Sills project from the wall faces but lintels are set flush. Stonework is stained from air and waterborne pollutants but is otherwise in good condition.

This house was painted with the same color schemes and during the same time period as the Main Arsenal and Commanding Officer's House. Repainting the house is presently not proposed, but a discussion of the issues involved can be found in Section VIII.

4. Chimneys

Historically four chimneys, two on each side of the front section of the house, remained in place until at least 1932, probably until c. 1937. The remaining single chimney of the rear section was a greater height than now exists. The chimneys were also painted; in the second color scheme, yellow ochre with the decorative brick caps in red-brown.

5. Windows, Doors, and Exterior Wood Trims

Wood windows, doors, and eave trims are in fair to good condition, although some elements may need replacement. All woodwork needs refinishing. The window for the front pediment still exists, laying on the attic floor.

6. Shutters

The house also had its shutters in place as late as 1932.[12] These were of louvered construction, painted a dark color, probably red-brown when the brick walls were yellow ochre. Except at windows which were changed or added, most of the shutter pintles still exist, and of course, are to be preserved. Subject to findings indicating otherwise, it appears that the house also may have had its shutters after the wall paint was removed.

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12. See Illustration 101.

7. Side Porch[13]

Although a later addition, the second floor portion of the side porch was constructed with the same post and railing detailing as the original. The roof line of the original porch can be seen along the brick walls of the house. The stair between first and second levels is of later, simpler detailing and could have been added later than the second level of the porch. Additional evidence of this is seen on the brick wall at the stair opening. The original ceiling and roof lines can be seen and between these a paint stain at the later second floor line. Lack of maintenance has brought about deterioration of the porch.

C. Existing Conditions - Interior

1. General

Material and finish descriptions used in this chapter are designated as prior to the autumn of 1977, since at that time, the Springfield Technical Community College was preparing the house to be used for an educational pilot project. These preparations included minor repairs and painting of the interior.

2. Structural System

Exterior and many interior walls are brick bearing walls. Floors and roof framing consist of heavy wood members. Typical first floor joists are 3 inches by 9 inches; spacing varies from about 19 inches to 24 inches on center. Floor framing of the second and attic floors are probably similar.

Roof framing[14] of the main section of the house consists of 4 inch by 5-1/2 inch to 6 inch rafters at 2 feet 2 inches to 2 feet 5 inches on center. At the side walls, these bear on 4-1/4 inch by 8 inch timber plates. The ridge pole is 2 inches by 6 inches. At approximately

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13. See Illustrations 106, 107, 110, and 111.

14. See Illustration 113.

half the distance from the side walls to the center of the house, the rafters are supported on longitudinal beams, braced both longitudinally and laterally to form a quasi-truss system. Joints in this truss system are mortise and tenon, and pegged. The wood of at least part of the framing is oak.

In the rear section of the house, framing consists of 3 inch by 8 inch ceiling joists at 20 inches to 21 inches on center over the second floor, and rafters are 4 inches by 5 inches at 28 inches to 29 inches on center. Both run in the transverse direction.

The roof sheathing is random width boards with splined joints along the edges. The chimneys were taken down to the level of the rafter bearing plate. All four chimneys had two flues and are 3 feet 4 inches wide and project 12 inches into the attic from the interior face of the exterior wall at that level. The roof openings were sheathed over.

The roof framing is in good condition, however, the knee braces at the center of the main roof were removed.

3. Basement

Assuming that the design of Building 10 is the same as shown for Building 4 on the 1876 plan, the basement of Building 10 was reconstructed nearly identically to its original configuration when the house was moved. This was, however, necessary since the interior walls support bearing walls in the upper floor levels.

The foundation/basement walls were rebuilt of rough stone up to a level of about 1 foot below the basement window sills. The remaining portions up to the stone water table are brick. These brick sections were probably rebuilt after the house was relocated. The interior basement bearing walls are brick, which was undoubtedly also the original material. Most of the openings between basement rooms are in the same location as the original. Even an opening between the front two rooms was rebuilt but was bricked up sometime after the house was moved.

The opening between the two rooms at the southeast side of the main section was rebuilt but was later relocated slightly. Between the two rooms of the present rear section, one opening had not been rebuilt, the other was not rebuilt in the same location. The exterior access stair was rebuilt, but the direction of run of the stair to the first floor was reversed. The original furnace enclosure was apparently not rebuilt. The floor is now concrete.

Brick trimmer arches support fireplace hearths. First floor framing consists of 3 inch by 9 inch wood joists at 19 inches to 21 inches on center in the front section of the house. Under the parlors, the joists at each side of the fireplace trimmer arches are 6 inches by 9 inches. In the rear section of the house, the first floor joists are 3 inches by 9 inches or 3 inches by 8 inches at about 24 inches on center, with one 6 inch by 9 inch in the framing under the original dining room. The 1876 plan indicated the floor to ceiling height to have been 9 feet 9 inches. The existing dimension from the concrete floor to the bottom of the floor joists is 8 feet.

4. First Floor

a. Entry Hall, Rooms 101, 101A, and 101B

The original entry door and its sidelights still exist, but the original entrance hall has been partitioned to create separate entries to the first and second floors. These partitions may be from the 1937 WPA remodeling.

The original stairway to the second floor changes from a straight run to a quarter circle turn at the upper end.[15] The beautifully curved wood handrail, the turned wood balusters, and the wood newel post are in good condition.

15. See Illustration 112.

In what is now the inner hall portion, Room 101B, a closet was built on the north side and at the east end of the wall, a doorway was cut into the former closet, which was converted into a bathroom, Room 105. The 1876 plan shows a heat register in the floor at this location, but it was removed. The closet doors are missing.

In the northwest corner of space 101A are plumbing risers serving a bathroom above, and there is a radiator beside the stairway.

The entry door suffers from paint build-up and marred wood. The windows and woodwork are in better condition. Acoustical tile was applied to the ceiling. Paint and wallpaper on walls in spaces 101 and 101B are in poor condition. Wallpaper in space 101A is a small geometric pattern and in fairly good condition. The plaster of the southeast wall of space 101 is cracked. The floors are covered with linoleum, which is in poor condition.

b. <u>Front Parlor, Room 102</u>

The most significant changes to the front parlor were the elimination of the large doorway between the two parlors and the infill installed in the fireplace opening. The doorway trim was removed, the opening closed, and the wall replastered. The original doorway opening was approximately 6 feet 9 inches wide, in the center of the wall. A new doorway was cut near the south end of the wall. The only visible evidence of the original opening is a joint in the wood base trim. The fireplace mantelpiece was left in place but the opening closed. These changes may have been part of the WPA remodeling work done in 1937.

The ceiling, walls, and woodwork are in fair condition, but need minor repairs and refinishing. Folding wood shutters in window jamb pockets are inoperable because of paint build-up. Windows also suffer from paint build-up, marred sash, a few broken or cracked glass panes, and broken sash balance weight ropes. The doors are missing (one to the hall, Room 101B, and one to the rear parlor, Room 103).

Steam pipes from the basement to the second floor were added on both sides of the window at the northwest corner of the room, with a radiator in front of the window. At the east side of the door to the hall, the 1876 plan indicated a heat register in the floor, which was later removed. Wood shelves were added beneath the windows in the south wall. The ceiling light fixture is of modern origin.

Visible room finishes prior to autumn of 1977 were:

Ceiling: paint, white
Walls: paint, pink, over wallpaper
Woodwork: paint, white
Floor: linoleum, brown

c. Rear Parlor, Room 103

Several modifications were made to this room. The large doorway, in the south wall, to the front parlor was removed, as previously described. The 1876 plan indicates double pocket doors would have been at this opening. The opening was closed and a closet built on the rear parlor side of the opening. There may be a duct chase in the north end of this closet. In the southwest corner of the room, what would appear to be a closet adjacent to that first mentioned was also constructed, but a doorway to the front parlor was built in the original wall, creating a passage. The closet construction is wood frame with wallboard and masonite and may be later than the 1937 changes.

Evidence of the former doorway to the Library, Room 104, is indicated by base trim insertions. A heat register in the floor at the north side of the room, as indicated on the 1876 plan, no longer exists. Twentieth century steam pipes to the second floor flank the northeasterly of the two windows in the south wall, and there is a radiator in front of the window. The fireplace mantelpiece was removed, and the opening closed. Walls had an additional layer of either plaster or wallboard, which reduced the woodwork trim projection from the wall surface.

The ceiling, walls, and woodwork are in good condition, but do need minor repairs and refinishing. Folding wood shutters in window jamb pockets are inoperable because of paint build-up. Windows are in fairly good condition but also suffer from paint build-up and cracked glass. Wood panels beneath the windows are painted. Prior to autumn of 1977, the visible finishes consisted of:

Ceiling: paint, white
Walls: paint, pink, over wallpaper
Woodwork: paint, white
Floor: linoleum, brown

d. Library, Room 104

The exterior brickwork at the eastern window of the north wall is an example of evidence that Building 10 was originally identical to Building 4, which the 1876 plan illustrates. The plan shows no window at this location, but brickwork at the window openings appears to have been reset. Also on the interior, the window width in relation to the wall space between the fireplace and the corner of the room is less than that at the window at the opposite side of the fireplace.

The fireplace mantelpiece was removed and the firebox opening closed. A former doorway in the west wall was removed and the opening closed. This doorway was to the former closet which was converted to a bath (Room 105). Two steam pipes to the second floor are in the northwest corner of the room and there is a radiator in front of the window. The heat register at the west wall shown on the 1876 plan does not now exist. In the south wall, the removal of the doorway to the rear parlor has previously been noted.

The door at the opening in the east wall (to Room 106) is missing. Between the doorway and window, the built-in glass-doored cabinet shown on the 1876 plan still exists. The wood panel beneath the window to the right of the fireplace is warped. The door is missing at the opening to the hall, Room 101(B).

The conditions of the windows, ceiling, walls, and floor are similar to those described in the parlors. Prior to autumn of 1977, the ceiling and woodwork were painted white, walls were painted light blue over wallpaper. The floor was covered with linoleum, which was in poor condition.

e. Bathroom (formerly Closet), Room 105

The original doorway to this closet area was from the Library (Room 104). This was closed and a new doorway cut to the entry hall. The space under the stair was also utilized for this bathroom conversion. The fixtures and finishes are about mid-20th century. A window in the north wall is not shown on the 1876 plan.

Finishes are in poor condition: ceiling plaster is cracked, wall and woodwork paints are chipped, linoleum on the floor is worn. The window also needs repair and broken glass replaced.

f. Rear Entry, Room 106

Three spaces, Rooms 106, 107, and 108 were created by partitioning the original dining room. The existing doorway to the side porch was originally a window, although the position of the opening was shifted, as can be seen in the exterior brickwork. At the southwest corner of this entry area, a stairway leads to the basement. This stair has been rebuilt as it originally went to the second floor. Steam risers in the northeast corner and a pipe chase in the northwest corner are intrusions. A heat register in the floor at the north wall shown on the 1876 plan no longer exists. The door to the basement stair is modern, as is the one to Room 108. The doors at openings to Rooms 107 and 104 are missing.

The ceiling and woodwork are painted white walls are painted, and the floor is covered with linoleum. Materials and finishes are in fair condition.

g. Room 107

This small room is very simple and reflects the period when the partitions were put in, subdividing the dining room. Ceiling and walls are painted and wallpapered. Linoleum covers the floor. Finishes recorded prior to autumn of 1977 were:

Ceiling: paint, white
Walls: paint and wallpaper; yellow paint on south wall; paint on east wall, wallpaper on west wall
Woodwork: paint, white
Floor: linoleum, brown

h. Room 108

This space became a small bedroom when the original dining room was subdivided, possibly 1937 or later. Closets are built into the east end of the room (one serves Room 110). In the south corner of the room was the original stairway to the basement. This no longer exists, but the corner space was converted to a closet. Materials and finishes vary in condition. Finishes recorded prior to autumn of 1977 were:

Ceiling: textured, painted, white
Walls: paint over wallpaper; blue paint over wallpaper on south wall; blue paint on east wall
Woodwork: painted, white and grey
Floor: linoleum

i. Room 109

This space originally was a service area between the dining room and the original kitchen in the rear section of the house, which no longer exists. The existing kitchen conversion appears to be c. 1950s. There were originally two windows in the north wall. One was removed and the opening closed. Its location can be seen in the exterior brickwork and the stone lintel is still in place. The door to the non-existant rear section of the house was removed, a window substituted, and the lower portion of the opening closed in. The exterior brickwork again shows the door opening location.

The metal kitchen cabinets, sink, and room finishes are in fairly good condition and could be used. Finishes recorded prior to autumn of 1977 were:

Ceiling: paint, white
Walls: paint, blue, upper portion; grey linoleum, lower portion
Woodwork: paint, white
Floor: linoleum, brown on 1/4 inch plywood over 1/4 inch asbestos tile, 1 inch flooring, 1-1/4 inch subflooring

j. Room 110

This room was originally a pantry with access to Room 109 and to the original dining room. The 1876 plan indicated shelves, drawers, and a sink in this pantry. The doorway to the dining room now gives access to a closet, and is fitted with doors on roller tracks. The door to Room 109 is missing. Steam or plumbing risers to the second floor are located by the room's only window in the south wall, and near the northwest corner of the room. Finishes, in fair condition, recorded prior to autumn of 1977 were:

Ceiling: textured, painted, white
Walls: painted, light orange-red. Interior of closet painted light grey
Woodwork: painted, white
Floor: linoleum, brown

5. Second Floor

a. Hall, Rooms 201 and 201A

The main hall had been subdivided (probably 20th century) by a wall and doorway at the left of the main stair. Ceiling and wall finishes here are fair, but wallpaper and paint in some areas are peeling and some cracks are evidence in plaster. Prior to the autumn of 1977 finishes recorded were:

Room 201 - Ceiling: acoustical tile
Walls: wallpaper, same as stairwell
Woodwork: painted, white
Floor: wood

Room 201A - Ceiling: painted, white
Walls: paint, pink, over wallpaper
Woodwork: painted, white

b. Room 202

This space was originally part of a bedroom which was subdivided into a hall and bath. Existing materials and conditions are similar to those of the main hall.

c. Bath, Room 203

This bathroom conversion of the original bedroom contains 20th century fixtures and finishes, which are in fair to poor condition. Finishes recorded prior to the autumn of 1977 were:

Ceiling: painted, cream
Walls: lower portions, linoleum panels; upper portions, plaster, painted mint green; tub section, beige tile
Woodwork: painted, white
Floor: wood and linoleum

d. Bedroom, Room 204

The size and arrangement of this bedroom is similar to the front parlor directly below. Like those of the first floor, the fireplace in the south wall has been closed in. There is one radiator at the window at the center of the building's front wall. Materials and finishes are in fair condition, but the door to the main hall is missing. The doorway in the southeast corner of the room was originally to a closet, but the back wall was removed and a new opening built for a passage to the adjacent bedroom, Room 205. Finishes recorded prior to autumn of 1977 were:

Ceiling: painted, white
Walls: paint, pink, over wallpaper
Woodwork: painted, white
Floor: wood

e. Bedroom, Room 205

The 1876 plan of Building 4 shows a window in what would be the existing east wall of Building 10. There is no window at this location, however, and the exterior brickwork does not indicate the former existence of a window. Again the fireplace has been closed in, and a radiator installed in the room. As mentioned above the closet of the front bedroom was modified, the wall location changed and doorway installed. There is no evidence of a door at the later opening. The closet at the southwest side of Room 205 is in poor condition, and room finishes are in fair to poor condition. Finishes recorded prior to autumn of 1977 were:

Ceiling: painted, white
Walls: paint over wallpaper. The closet/passage conversion is painted light blue.
Woodwork: painted, white
Floor: wood

f. Bedroom, Room 206

Except for the closure of the fireplace and the addition of a radiator in the west corner, this room has had no major changes. The large closet off the west side of the room has not been changed. Windows and doors need repair and the room needs to be refinished.

g. Room 207

Some evidence remains of elements in this space which would indicate the original floor plan to have been similar to that of Building 4, as shown on the 1876 plan. Whether the arrangement was identical has not yet been determined. A window in the north wall was removed and the opening enlarged for a door, which now gives access to the second floor side porch. In the southwest corner of the room, a stairway originally gave access to the first floor. This has been removed but the stair space still exists although it is inaccessible. The closet in the northeast corner of the room was converted to a china cabinet and the space indicated on the 1876 plan as a water closet was converted to a closet, the door of which is now missing. There is a radiator in the southeast corner of the room. Prior to the autumn of 1977 walls in the room were painted mint green and the interior of the closet was painted grey.

h. Bath, Room 208

Possibly part of an original storeroom, most existing interior walls are 20th century. The ceiling is painted grey, upper portions of walls are painted ochre, lower portions are tiled. The room and fixtures are in poor condition.

i. Bedroom (later Kitchen), Room 209

This space was originally a bedroom, with a partition dividing it into a sleeping area at the north end, having a closet between the chimney stack and north wall, and a dressing area with a sink in the east corner. The partition and closet are now gone and the space converted to a kitchen during the 20th century.

The walls have been painted yellow. A wood wainscot along the south wall of 3 inch to 4 inch wide boards was painted yellow and peach. Kitchen cabinets at the north portion of the room appear to be c. 1950s. The room is in fair condition, but paint is peeling and plaster is cracked in some areas.

D. Building Systems

1. Water Supply and Sanitation

The sanitary drains are in poor condition with leakage and cracked pipe. The water system also exhibits some leakage and damage.

2. Environmental Controls

The existing heating system is steam with radiators at various locations throughout the house. The steam supply was from the central plant which supplied the other Armory buildings. The supply lines are apparently in poor condition as in the autumn of 1977, the college had installed a boiler to heat the house in preparation for using the building for a special educational project. The condition of steam pipes and radiators within the house was not yet determined.

3. Electrical System

The house wiring is suffering from the same deterioration exhibited by the other park structures, old wiring and antiquated voltages.

4. Security and Fire Detection

The building is not protected by fire or security systems.

E. Recommendations

1. Exterior

a. Roof

The slate roof should be retained and minor maintenance and slate replacement performed to ensure weather tightness.

b. Flashings, Gutters, and Downspouts

(1) Ridge Caps

Damaged sections will need new copper replacements. Some sections can be reused after repair of holes.

(2) Eave and Chimney Flashings

Repair flashing. Should repair procedure reveal pinholing or other deterioration, copper flashings should be replaced with new.

(3). Gutters

Repair all gutters and repaint the external gutters of the entrance portico and side porch.

(4) Downspouts

Replace existing and missing copper downspouts.

c. Masonry

Repoint both stone and brick as recommended for Buildings 1 and 13.

d. Windows, Doors, and Trim

(1) Fan Window

Preserve window stored in the attic for future use should an earlier restoration date be selected in the future.

(2) Windows and Doors

Repair windows and doors, replacing deteriorated members when necessary. In some cases consolidation and repair of sills using epoxies may be feasible.

(3) Trim

Repair and refinish exterior trim. Limited replacement of deteriorated members may be required.

e. Side Porch

Repair the side porch using existing materials when possible, replacing deteriorated members with new. Provide new roofing and flashings similar to the existing.

2. Interior

a. General

Leasing of the building is the anticipated use of Building 10. In order to establish suitable conditions for leasing several general actions should be taken.

b. Walls and Ceilings

Repair and refinish walls and ceilings. Remove deteriorated wall finishes. Where possible retain sound historic finishes and refinish over them. Acoustical tile can remain if in sound condition.

c. Floors

Strip back flooring materials to wood flooring, then repair and refinish wood floors. Provide new floor cover if floor cannot be refinished. If carpeting is considered, remove existing floor covering to expose a sound level surface and install carpet and pad.

d. Window, Doors, and Woodwork

(1) Windows

Repair and refinish windows. Restore shutters in window jamb pockets to operable condition, this will require removal of built-up paint layers.

(2) Doors

Repair and refinish doors throughout the building. New reproduction doors will be required in Room 102 and Room 204.

(3) Woodwork

Repair and refinish woodwork throughout the building. The main stair railing requires only cleaning and protective wax.

e. Contemporary Partitions

Depending on tenant needs, 20th century non-load bearing partitions can be removed.

f. Bathrooms

Clean and repair bathroom finishes. Replace fixtures with new fixtures similar to the old in character and style.

g. Kitchen

Repair or replace kitchen cabinets or counters. If kitchen function is not required, removal can be considered.

3. Building Systems

a. Water Supply and Sanitation

The water system should be repaired where necessary. Sanitary drains require replacement where damaged and leaking. Both systems should be surveyed in greater detail should building operations indicate further problems.

b. Environmental Controls

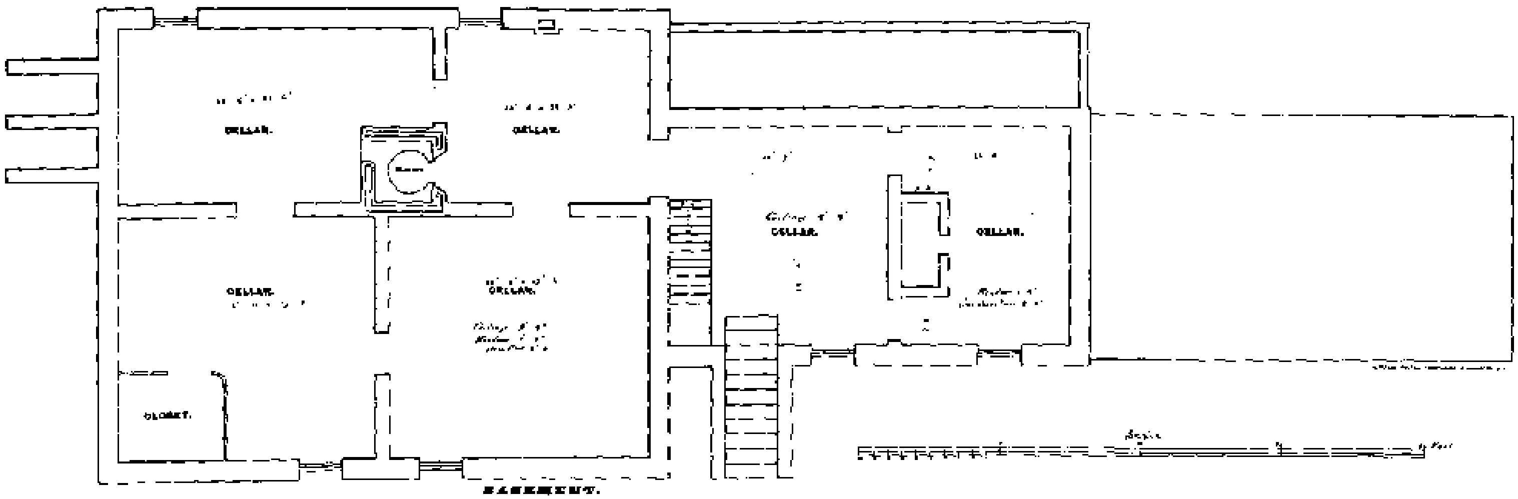
A new mechanical system is required unless provisions can be made to retain the STCC boiler currently in place. If the National Park Service must purchase a new system, conversion to hot water heat should be considered and energy conservation issues should be addressed.

c. Electrical System

The building should be rewired and service converted to the new park voltages.

d. Security and Fire Detection

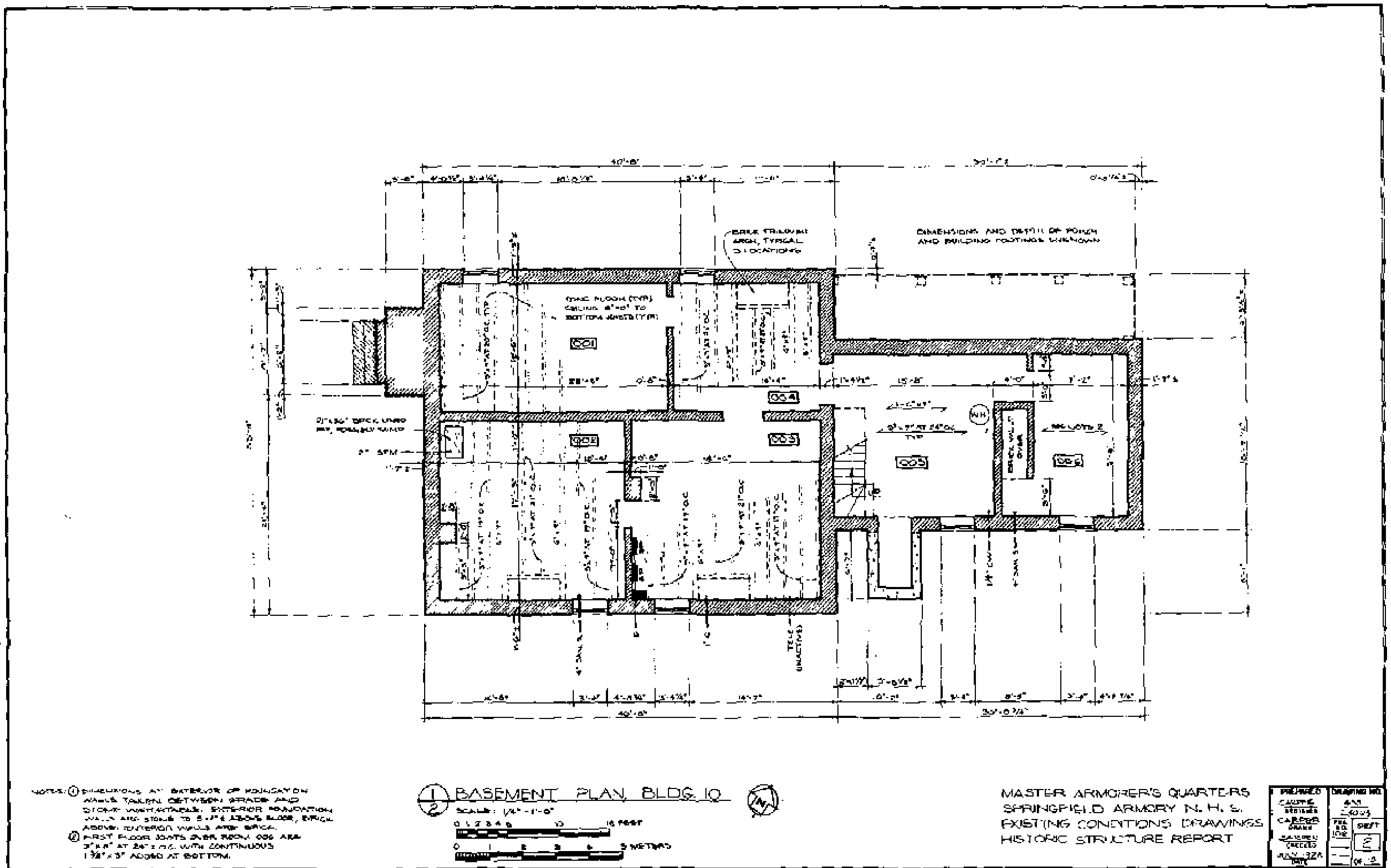
The building should be tied into the park security and fire detection system.



1876

Illustration 95
Building 4, Basement Floor Plan, Similar to Building 10
Officer's Quarters at the Arsenals and Armory, GPO, 1876

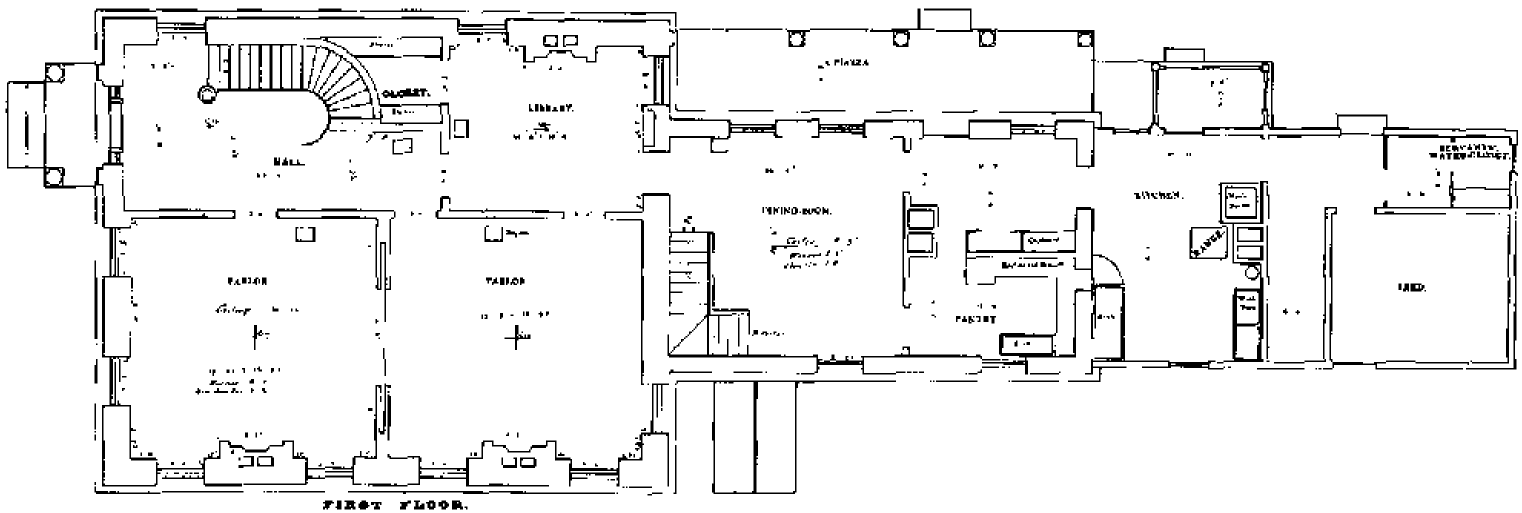
1876



1977

Illustration 96
Building 10, Basement Floor Plan
Historic Structure Report Drawings, Carper

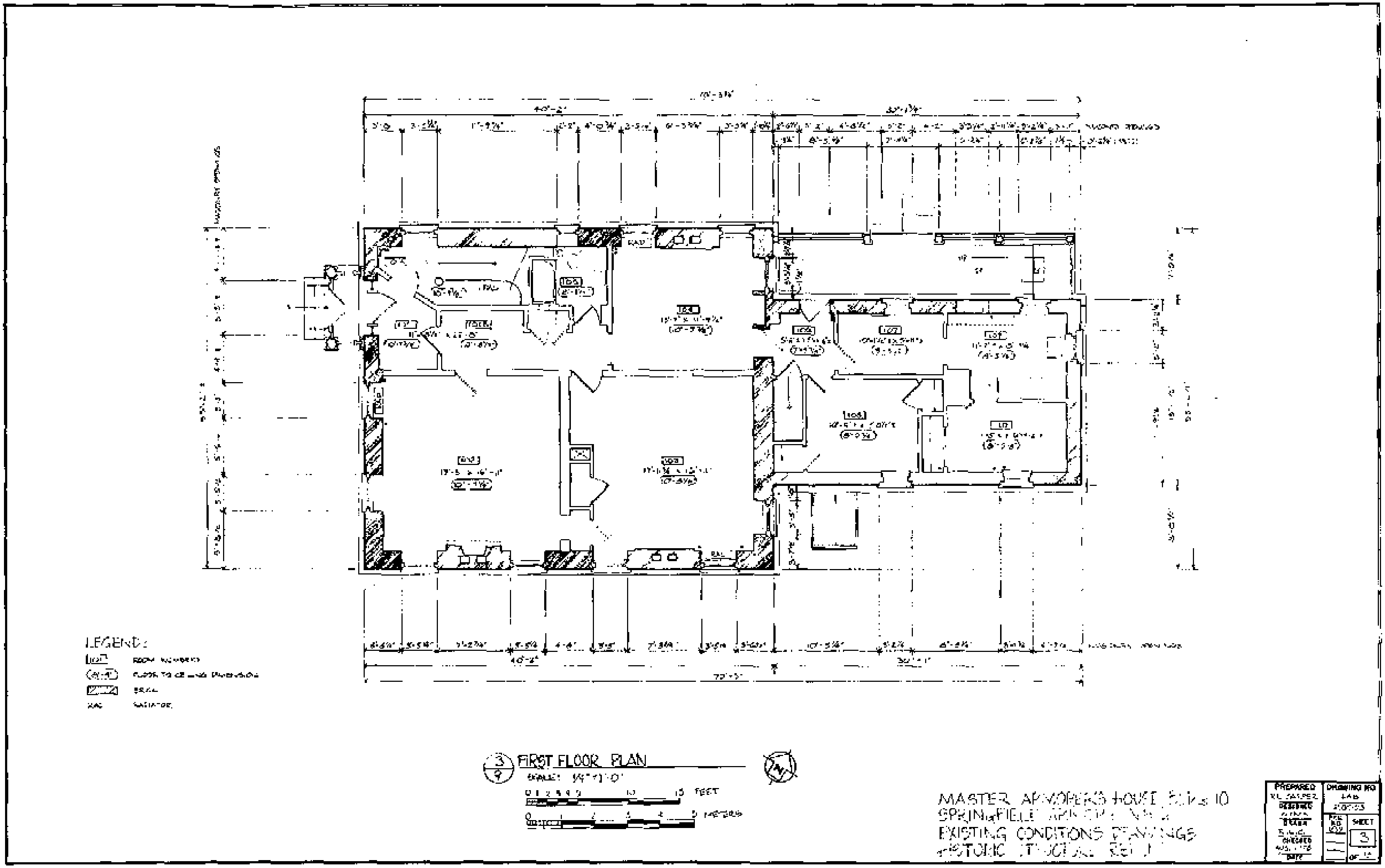
1977



1876

Illustration 97
Building 4, First Floor Plan, Similar to Building 10.
<u>Officer's Quarters at the Arsenals and Armory</u>, GPO, 1876

1876



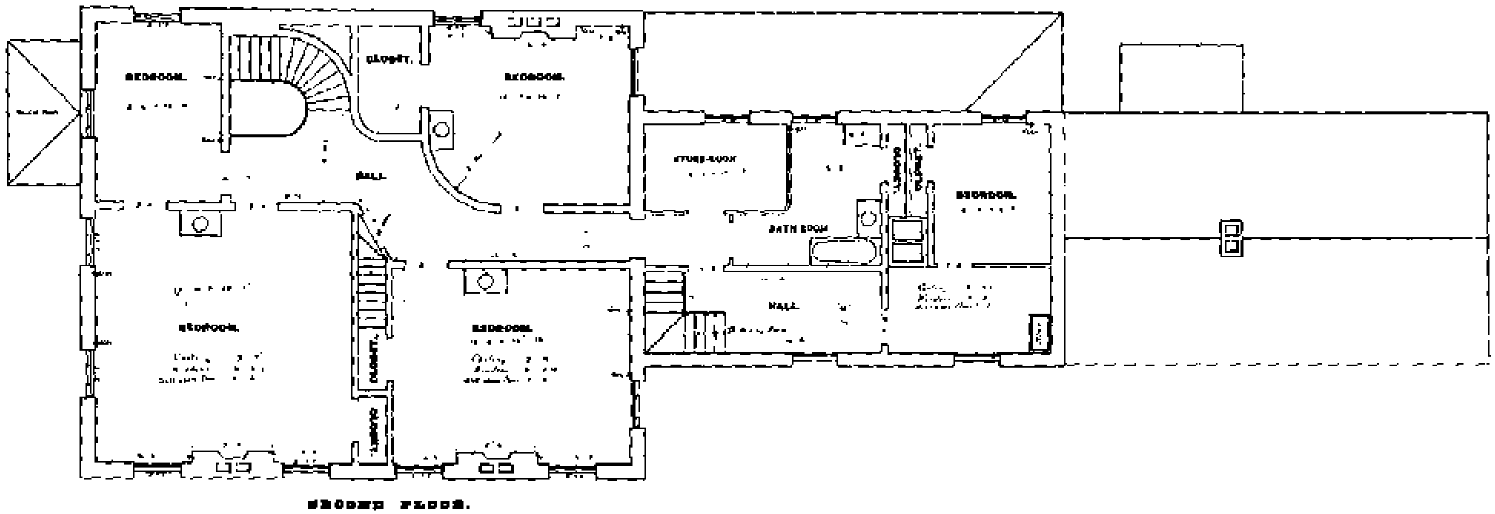
ON MICROFILM

1977 Illustration 98
Building 10, First Floor Plan
Historic Structure Report Drawings, Carper 1977

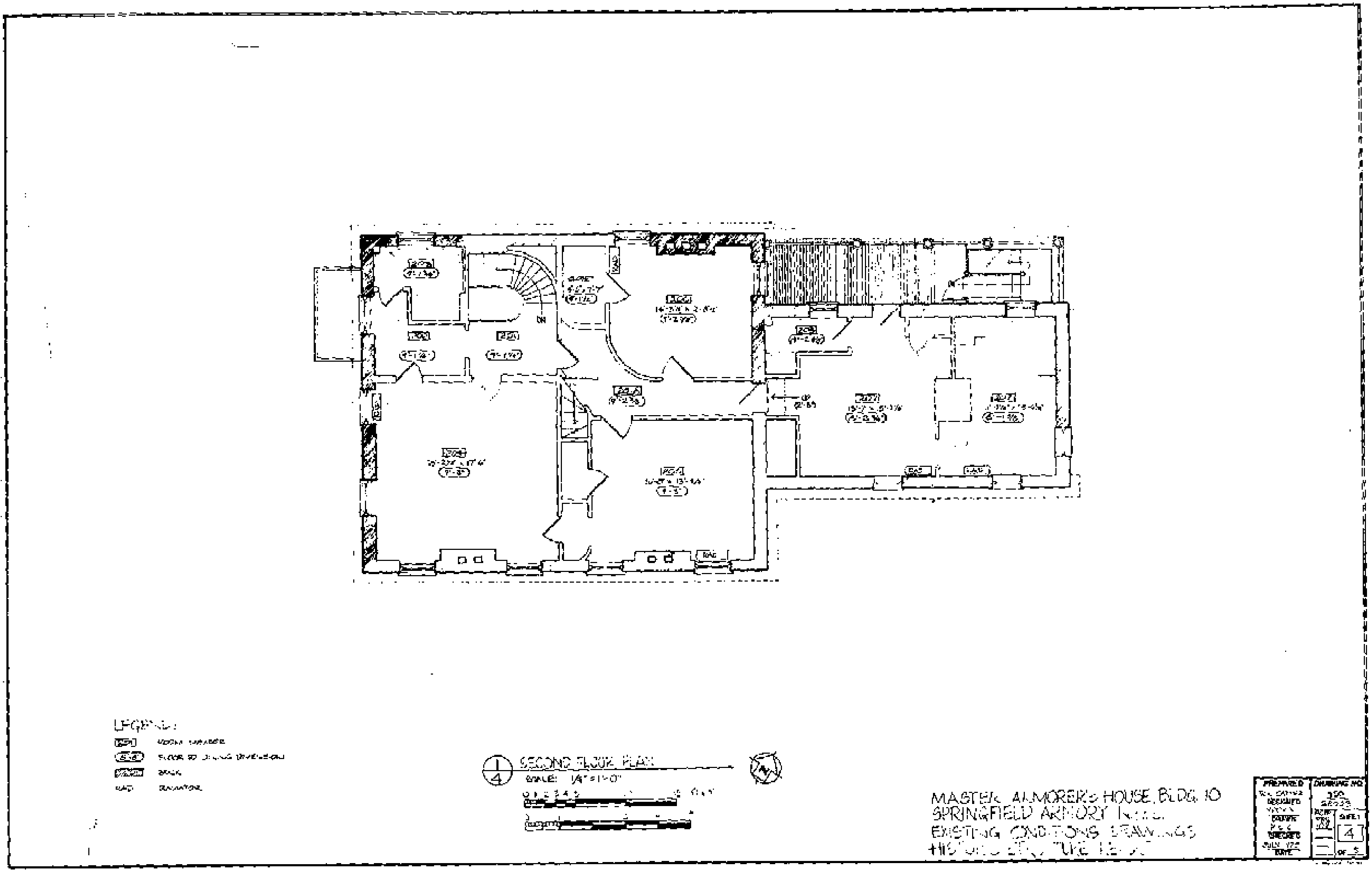
OFFICERS QUARTERS NATIONAL ARMORY.

ASSISTANTS.

No. 4.



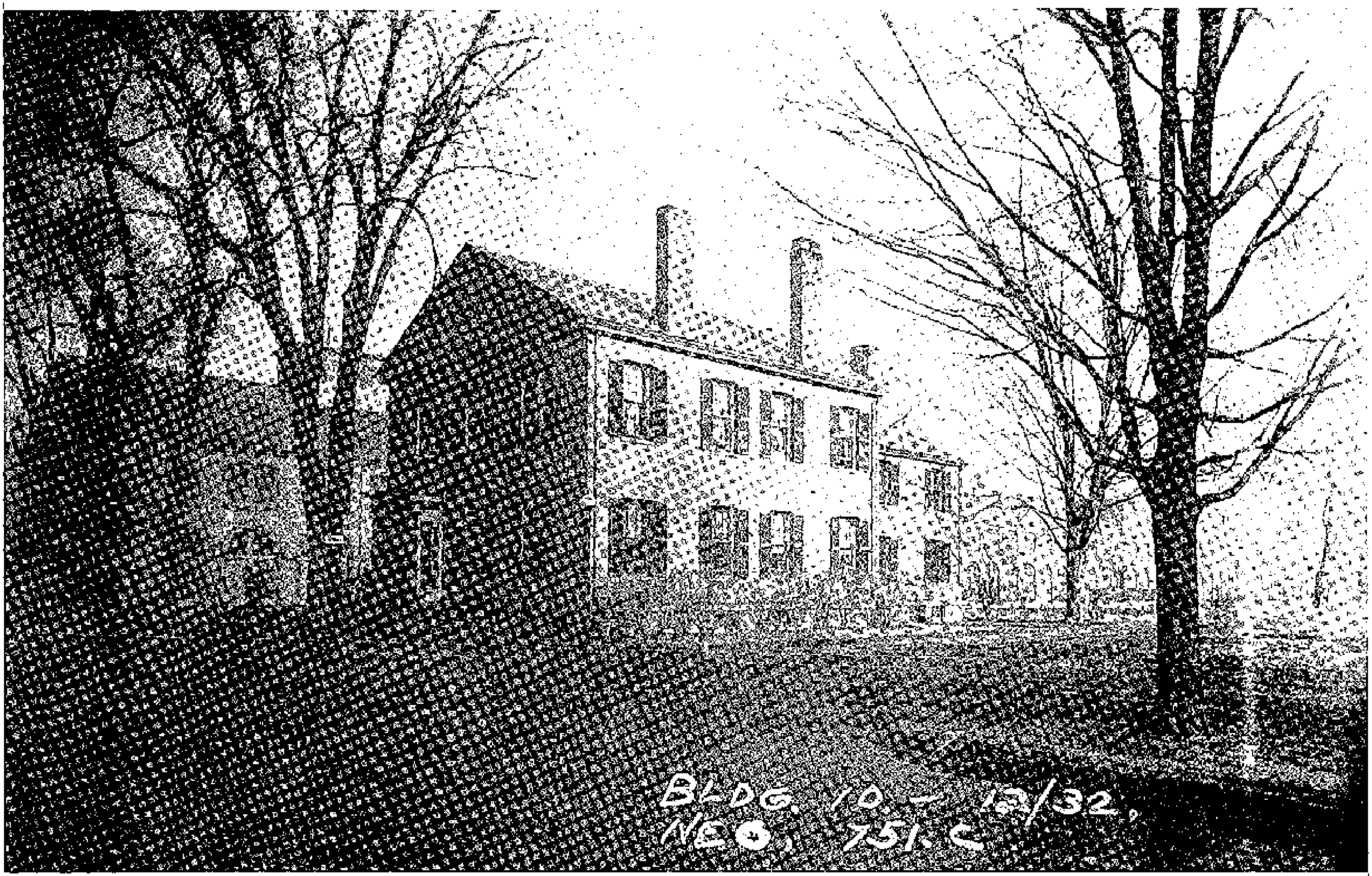
1876 Illustration 99
Building 4, Second Floor Plan, Similar to Building 10
<u>Officer's Quarters at the Arsenals and Armory</u>, GPO, 1876 1876



1977

Illustration 100
Building 10, Second Floor Plan
Historic Structure Report Drawings, Carper

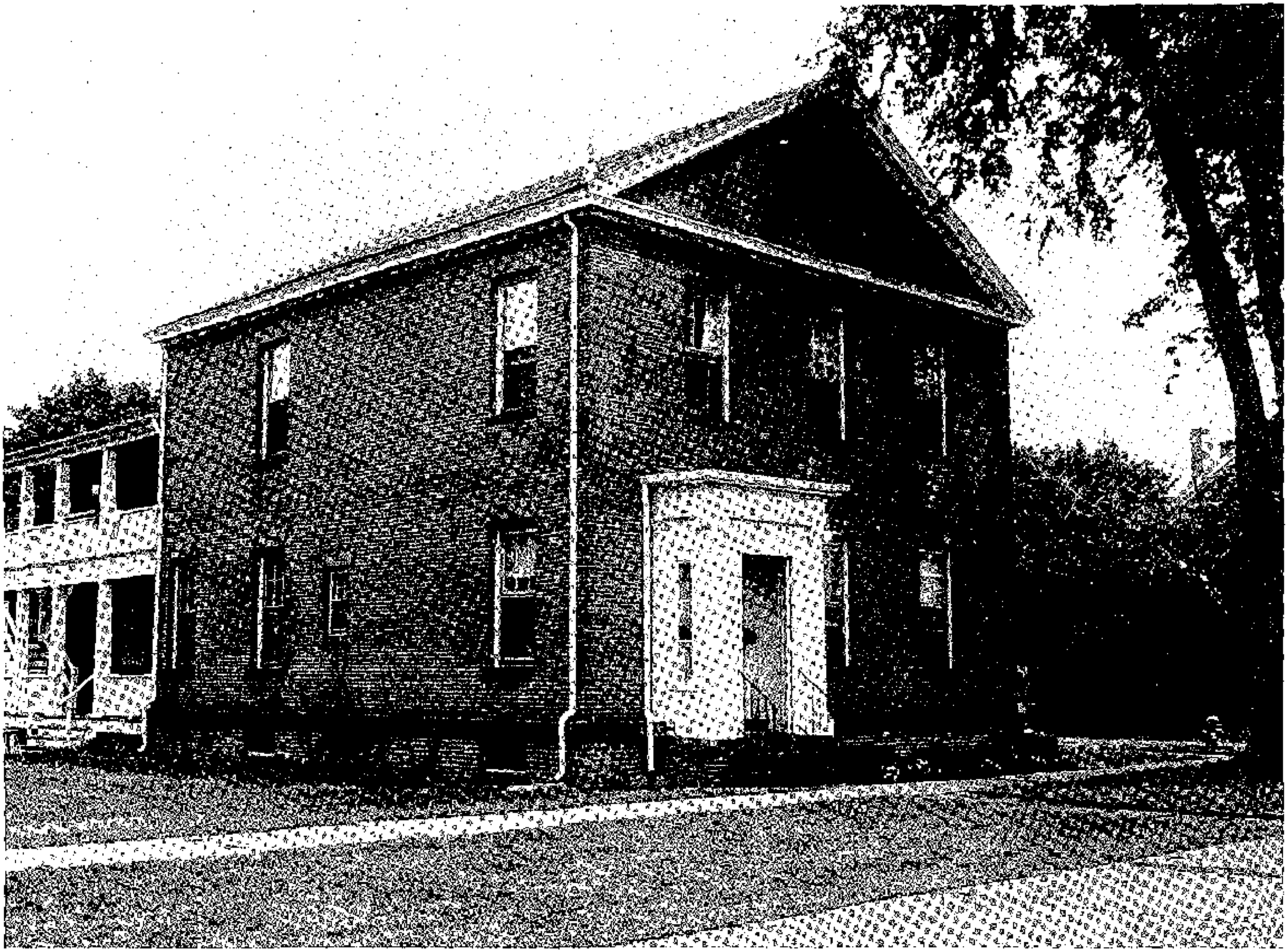
1977



1932

Illustration 101
Building 10, View from Southwest
Springfield Armory Files Negative No. 751-C, NPS Park Files

1932



1967 Illustration 102
Building 10, View from Northwest
NPS Evaluation Report, 1967 1967

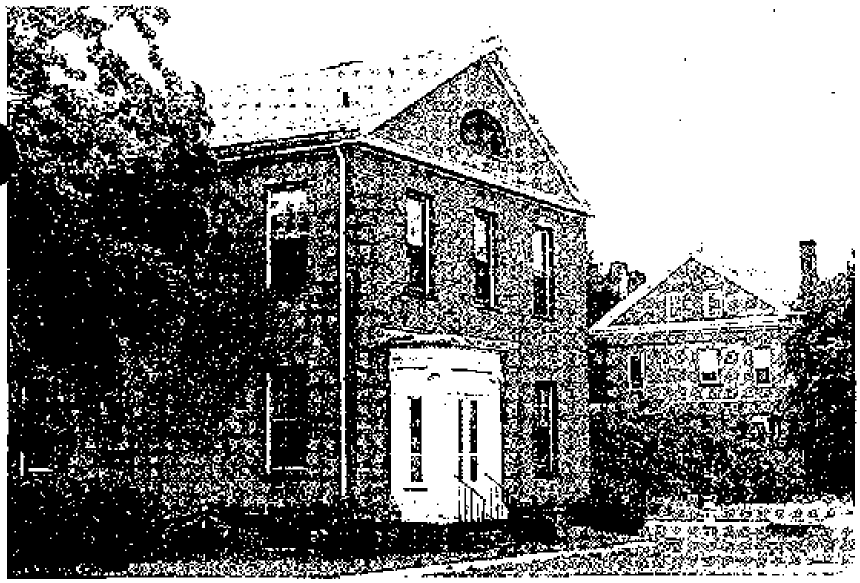


Illustration 103
Building 10
View from Northwest

1976

NPS Photo, DSC

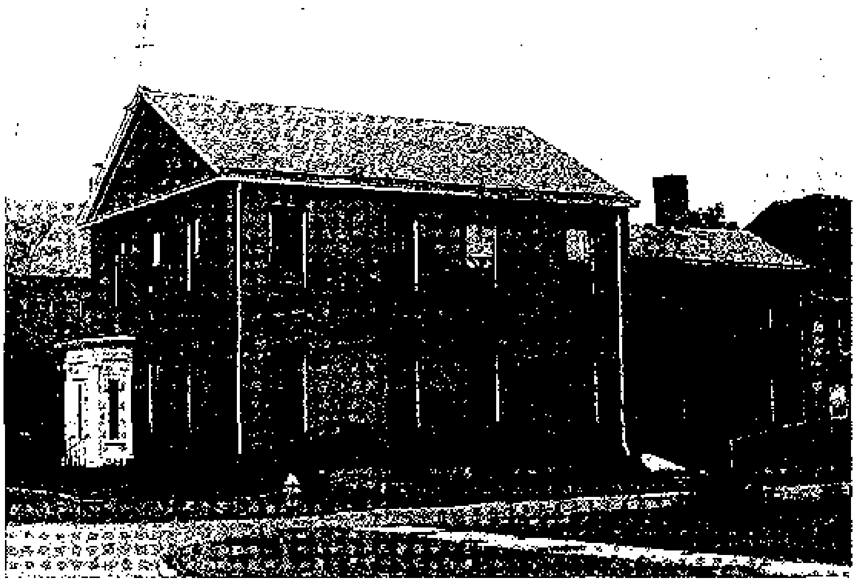


Illustration 104
Building 10
View from Southwest

1976

NPS Photo, DSC

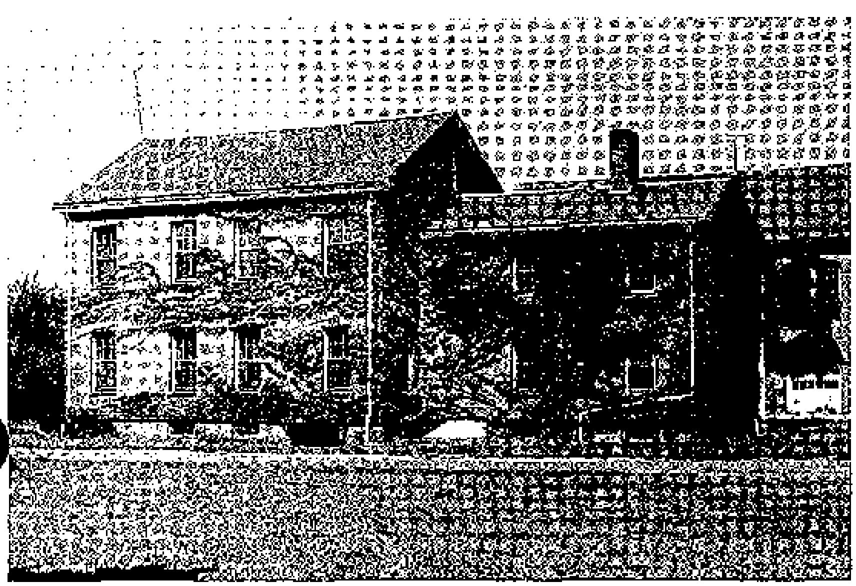


Illustration 105
Building 10
View from South

1976

NPS Photo, DSC

Illustration 106
Building 10
View from Northeast

1976

NPS Photo, DSC

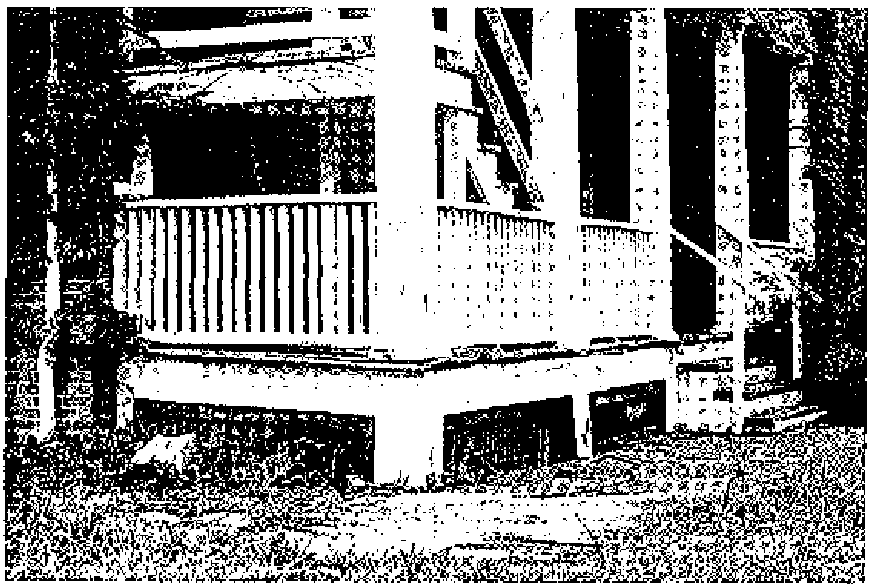


Illustration 107
Building 10
Northeast Porch

1976

NPS Photo, DSC

Illustration 108
Building 10
Water Table, Southeast Corner

1976

NPS Photo, DSC

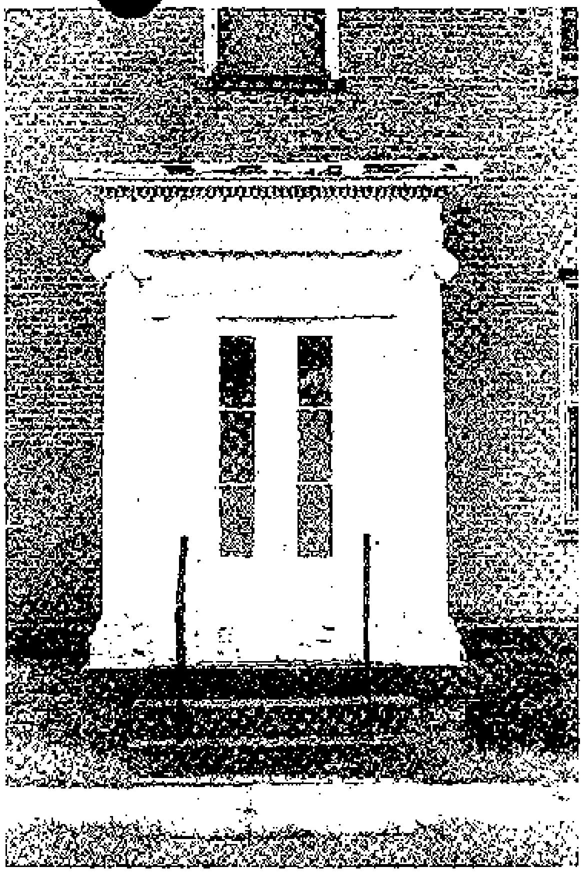


Illustration 109 **1976**
Building 10
Front Entrance

NPS Photo, DSC

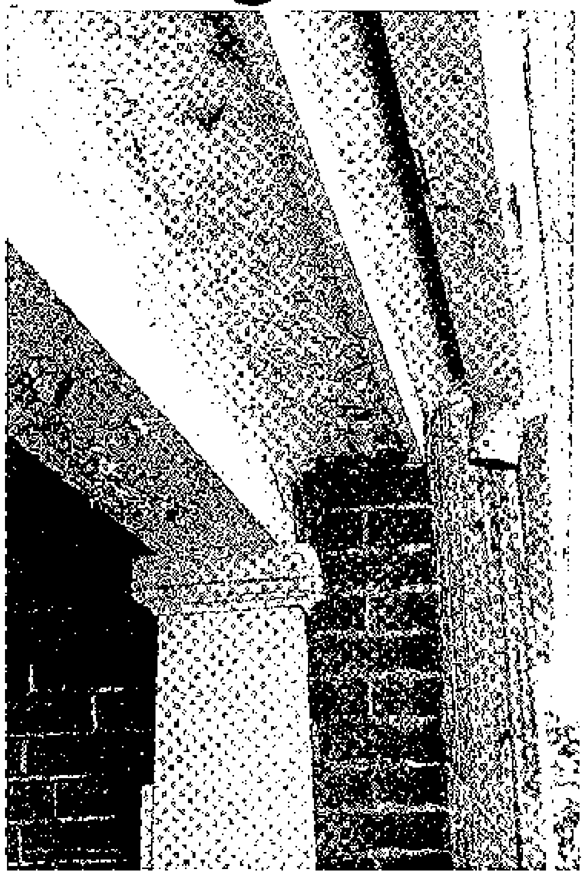


Illustration 110 **1976**
Building 10
Northeast Porch Detail

NPS Photo, DSC

Illustration 111 **1977**
Building 10
Northeast Porch Detail

NPS Photo, DSC

1977

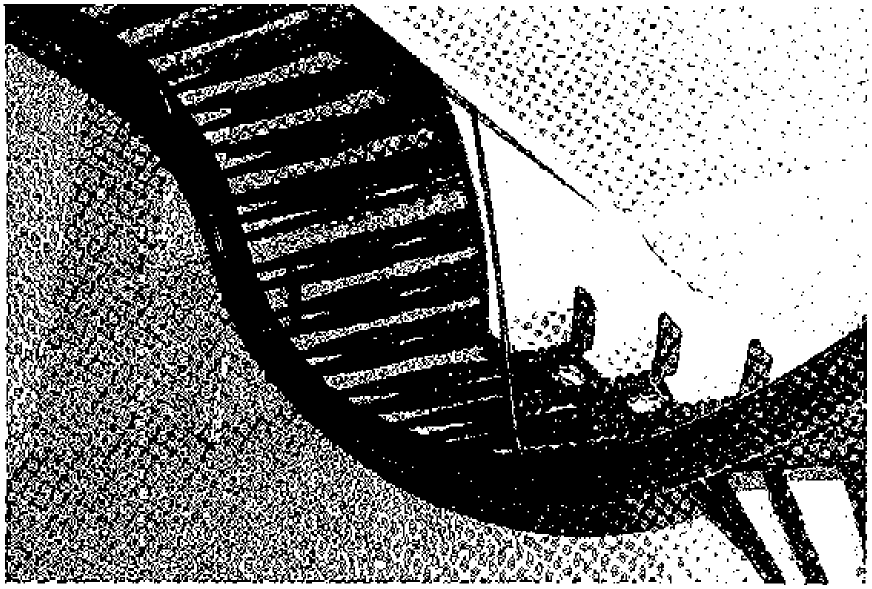


Illustration 112
Building 10
Main Stair

NPS Photo, DSC

1977

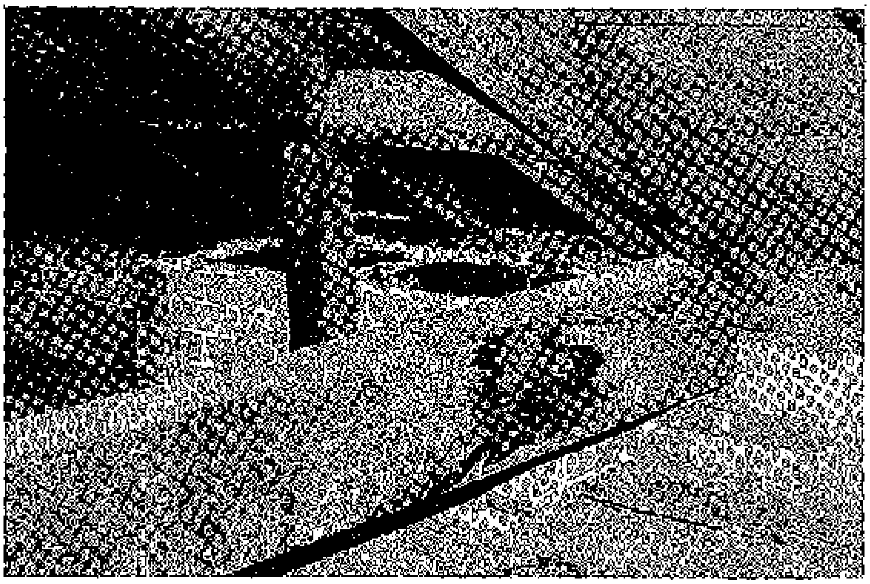


Illustration 113
Building 10
Attic Framing

NPS Photo, DSC

GATEHOUSE - BUILDING 33

V. GATEHOUSE, BUILDING 33

A. Evolution, General Description, and Existing Conditions

Until the 1870s the main gate was apparently on State Street at the intersection of the street which runs in front of the Main Arsenal. During the 1870-75 period, a new road was constructed from the corner of State and Byers streets to a point southeast of the site of the Paymaster's House and intersecting the road passing the Main Arsenal.[1] The Main Gate was moved to State and Byers and the old State Street entrance gate was replaced with a section of fence, although the pedestrian gate remained, and is still there today. About 1875 or 1876, a new gatehouse was built at the State and Byers streets entrance.[2] This gatehouse was octagonal, as shown in an 1884 illustration[3] and a c. 1886 photograph.[4] By 1908, the present gatehouse had replaced the c. 1875-76 one.[5] It is noted, however, that the present gatehouse was apparently at least planned in 1904, as a map of that year shows a rectangular one.[6]

This rectangular brick building measures 12 feet by 14 feet. The overall structure is lengthened 4 feet as two square brick columns at the southeast front, and the hip roof over the entire structure, provide a sheltered stoop. The structure is quite symmetrical, with a door in the southeast front, a window in each side, two windows, and a chimney at the rear.

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1. Albright, p. 60.

2. Ibid., pp. 60, 64.

3. Ibid., illustration 10, p. 71.

4. See Illustration 117.

5. Albright, p. 78.

6. Ibid., Map 13, p. 79. This map is dated May 2, 1904, with the notation "Showing location of buildings, roads, sewers, etc., Dec. 31, 1904, with contemplated changes to June 30, 1905."

B. Existing Conditions

The slate roofing is in good condition except for loose slates at the hips. The copper ridge cap appears to be in good condition, but the chimney flashing needs repair. The brick walls rest on a stone water table and are terminated under the eaves with a plain stone frieze, which is painted white. The brick wall pilasters are reminiscent of those of the Main Arsenal walls. Bricks are 2-1/2 inches by 3-3/4 inches by 8 inches; brick work is painted a dark red-brown.

The brick column at the right front has been rotated.

At the eaves, the wood soffits and fascia trim are in fair condition but paint is peeling. There are several coats of white over a brown or red-brown paint.

The stoop is a concrete slab. The windows and door are damaged and boarded up. The interior is in poor condition, having suffered from fire damage at the rear.

C. Recommendations

1. Although not dating from the most significant historic period of the Armory, this historic gatehouse is recommended for preservation as an element of the historic scene. After exterior restoration treatment and interior repairs and improvements, the building could be used as an entrance station during peak visitation periods or for special events.

2. Conduct historic finishes analysis and record interior, door, and window details.

3. Dismantle and rebuild the twisted brick column, right front.

4. Determine historic validity of white-painted exterior stonework. Remove or repaint according to findings.

5. Repair slate roofing and flashing where necessary. Chimney flashing needs repair.

6. Repoint masonry, including chimney where necessary, matching historic mortar. Repaint brickwork based on history and test analysis. Only minor repointing is anticipated.

7. Repair doors, windows, and trim.

8. Provide underground electrical service to building (with interior circuit breaker panel) and intrusion alarm system. Electric heating is recommended. Water and sewer services are not recommended.

9. Replace damaged interior materials, repair, and refinish all of interior as necessary.

1932

Illustration 114
Building 33, View from the East
Springfield Armory Files, Negative No. 783-C, NPS Park File.

1932

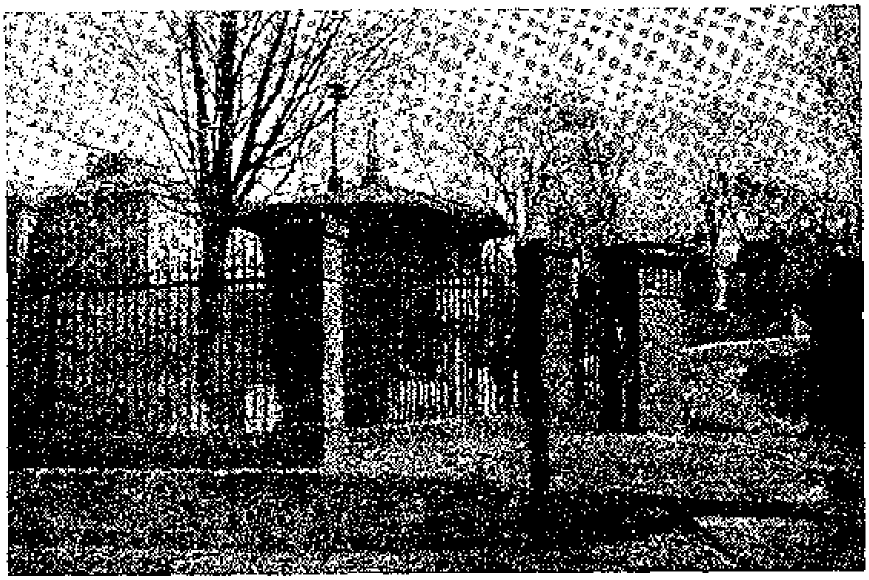
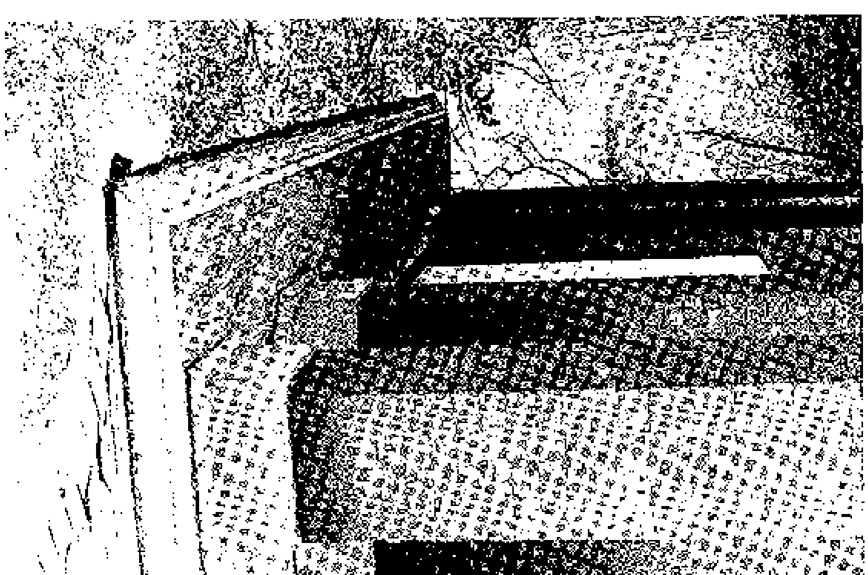


Illustration 117 **1891**
South Gate and First Gatehouse

Picturesque Hampden,
Warner, Charles F., 1891

Illustration 116 **1976**
Building 33
View from East

NPS Photo, DSC



1976
Illustration 115
Building 33
Detail Front Column and Eave

NPS Photo, DSC

GARAGE - BUILDING 18

VI. GARAGE, BUILDING 18

A. Evolution, General Description, and Existing Conditions

The two-car garage northeast of the Commanding Officer's House was built in 1937, apparently as a WPA project.[1] This brick building is approximately 21 feet 4 inches square and has a low-pitched hip roof with mineral-surfaced roll roofing. In contract to the other buildings, the craftsmanship of brickwork is very poor, but the structure is sound.

Bricks are laid with wide, variable joints in common bond with an alternating header/stretcher course each six or seven courses. Bricks are 2-1/4 inches by 3-1/4 inches by 7-3/4 inches. Walls are one brick length thick and unfinished, both exterior and interior. The wood eave trims are painted white.

Windows are wood, 6 over 6 light, double hung (two in the east wall, one in the west wall). The door in the west wall is a panel door with a four-light glazed opening. The vehicle doors are wood, partially glazed.

The floor is concrete with a center drain. A radiator at one time provided heat. Ceiling joists, covered with 1/8 inch asbestos sheets, appear to be 2 feet on center. Floor to ceiling clearance is 6 feet 6-1/2 inches.

B. Recommendations

1. Maintain the structure as maintenance and storage space.

2. Repair doors and windows as required.

3. Repair or replace roof drainage system.

4. Repaint

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1. Albright, p. 83.

FENCE

VII. THE IRON FENCE

A. Evolution, General Description, and Existing Conditions

The fence was also one of the important elements of Ripley's plan for Springfield Armory. He had had a wood picket fence constructed, but greater permanency and security were desired. Construction of the stone foundations for the iron fence were begun along State Street in 1847. The red sandstone was quarried at Longmeadow. But the patterns for the fence and gate were not approved by Ripley until 1852.[1] Casting of the fence began that year, additional foundations set along State and Byers streets, and the fence completed along State Street.[2]

The work did not progress well, and several periods of no progress are evident. In 1856 and 1857 the work continued on the stone foundations along Byers Street, then along Pearl Street. It was not until 1860 that the Byers Street fence was completed and the Pearl Street side begun.[3] Finally, in 1862, the fence around the Hill Shops was completed.[4] An 1892 reference described the fence as being painted black.[5]

The following description is taken from the 1967 "Evaluation" report:

> . . . the ironwork was cast partly by Cyrus Alger & Co., of South Boston, and partly by the Ames Manufacturing Company, of Chicopee.

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1. Albright, pp. 27-29.
2. Ibid., pp. 39-40.
3. Ibid., p. 48.
4. Ibid., pp. 48-50.
5. Ibid., p. 74.

Above a low sandstone base, halberd-headed posts approximately 9 feet high support base and top rails into which palings are inserted. Two forms of paling, round with spear heads and slightly lobed with pike heads, alternate. The gates are more intricately patterned, with oval center sections surrounded by lacy ironwork enclosing the palings. The alternating spear and pike motif is carried across the gate crestings. Square sandstone posts with glyphs below molded cornices capped by low square blocks support the gates.[6]

Temporary repairs were made by the park in 1977 of the portions of the fence surrounding that part of the Armory in NPS jurisdiction. Prior to those repairs, the following estimate of the number of elements requiring repair or replacement was made:

Rails	15
Main Posts	5
Main Post Heads	9
Palings	35
Paling Heads	47
Locks	4 (min.)

Also, one complete section of fence was missing.

Existing deterioration of some of the foundation stone is due to weather and damage resulting from the relocation of the fence along Pearl Street. In addition to repairs and replacement of broken and missing elements, the entire fence needs refinishing. The black paint is cracked and peeling, exposing the iron to the weather. Due to the intricacy of the elements, this work will be time consuming. An advantage, however, is that molds for the paling heads are available. Repair and preservation treatment of this historic fence is required to maintain the integrity of the site.

B. Recommendations

1. Conduct paint history analysis.
2. Repair or replace foundations.

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6. Office of Archeology and Historic Preservation, National Park Service, U. S. Department of the Interior, Springfield Armory, Evaluation Under Provision of Historic Preservation Act 1966, August 17, 1967.

3. Repair and replace iron elements as required. Replacement elements are recommended to be cast of mild steel to reduce galvanic action which would occur between dissimilar metals.

4. Remove loose and scaling paint. Treat bare metal with metal conditioner and rust remover. Prime bare metal with metal prime coat paint. Refinish all of fence with exterior black paint for metal.

Illustration 118
Fence
South Gate and Gatehouse

1976

NPS Photo, DSC

Illustration 119
Fence
Detail of Pales

1976

NPS Photo, DSC

BUILDING FINISHES

VIII. BUILDING FINISHES

A. General

The manner in which building finishes, particularly paints, are dealt with at Springfield Armory is dependent upon building use and the selected period of restoration. Stull Associates' sub-contractor Building Conservation and Technology, Inc., performed a basic finishes survey of Buildings 1, 13, 18, and 33 for the purposes of establishing major painting schemes and possible building alterations. Each individual paint layer was not coded to the Munsell System of Color Notation, but was simply identified with a general color description. The proposed building uses indicate that almost all existing finishes will remain in place. Should any future actions require removal of finishes any layers should be color coded and samples should be retained. Excerpts of the Stull report can be found in Appendix B-4, only the room finishes summaries have been included.

B. Exterior Paint and Period of Restoration

The exteriors of all the Armory buildings appear to have gone through a uniform progression of paint schemes, since a unified appearance was maintained throughout the complex. The major paint sequences for the building exteriors were as follows:

1847-52; masonry-unpainted; mill work-dark green
1852-c. 1880; masonry-medium orange-brown (salmon); millwork-medium brown
c. 1880-1937; masonry-yellow-brown (yellow ochre); millwork-medium brown
1937-today; masonry-unpainted, sandblast; millwork-cream

During the early 1900s millwork was occasionaly painted dark green while the brick remained yellow-brown. These periods do not directly relate to physical alteration of the structure, except the Commanding Officer's House porches were altered c. 1880, which correlates with the third major color change.

National Park Service management in deciding that 1968, the closing of the Armory, would be the period of restoration has preserved the option of future restoration while defining limits for correct development. However, should restoration to an earlier date ever be decided upon several issues should be considered.

1. Restoration to a period prior to 1937 would imply painting of the masonry in one of the historic color schemes. Unless STCC could be persuaded to go along with painting their structures, a unilateral painting of NPS structures would introduce a very jarring element into the historic scene. Any unilateral action should be discouraged.

2. In addition to esthetic questions, several technical questions would have to be addressed prior to any painting of structure. First, the brick surface texture after sandblasting is different than would have existed when the masonry was painted. This concern resulted in Mr. Carper's discussion of pargeting of the brick in previous drafts.

Second, paint films or sealants might restrict the flow of moisture out of the brick at the surface and accelerate brick deterioration during freeze/thaw cycles. This could cancel out any advantages in limiting moisture penetration into the brick. It must be noted that the existing brick surface, even though sandblasted, does not appear to exhibit significant deterioration after 45 years.

3. Restoration to a date prior to the addition of the existing ornamental cast iron porches on the Commanding Officer's House would require removal of the existing porches and reconstruction of the earlier porches. It is questionable that such a restoration could be legitimately justified.

Restoration to the 1968 date will imply maintenance of exterior finishes as they exist today, or a basic preservation approach. This philosophy will maintain a unity within the total historic site, while protecting other options for future years.

C. Interior Finishes and Adaptive Use

The first criteria regarding interior finishes should be preservation of as much of the fabric records as possible, while recognizing that adaptive use functions are necessary to justify the long-term preservation of the structures. The various types of adaptive use proposed place different demands on the interior fabric.

1. Exhibit Spaces - Building 13

The Interpretive Prospectus (IP) proposes to exploit the historic warehouse storage function and appearance of the Arsenal. This will require cleaning of existing finishes, repair of damaged surfaces, and refinishing to match the existing finishes where necessary.

2. Administrative, Collection Storage, and Laboratory Spaces - Building 13

These areas will require similar treatment to exhibit spaces with the basic goal being stabilization/preservation of the existing finishes. Cleaning, repair, and refinishing will be required. The existing finishes are compatible with the proposed uses.

3. Unassigned Spaces - Building 13

The basic philosophy remains the same, stabilization/preservation. Cleaning, repair, and refinishing will be required. Touch-up painting would be acceptable but the repairs required are extensive on the third floor, the primary unassigned space, and total painting might be required.

4. Leasable Space - Building 1

Exact finish requirements will only be finally determined when a tenant is known. However, two strategies should accommodate most tenants requirements.

First, removal of all leftovers from the 1977 interior decorator's show. In some cases painting is all that is required, but stripping of wallpaper and physical removal of more major alterations will be required in some areas. After removal of shows finishes, the intent will be to establish neutral off-white wall finishes and ceilings. These offer good surfaces for indirect task lighting systems to operate upon, and such systems would minimize tenant impacts upon building fabric. Floors should be restored to varnished wood flooring where existing floors can be restored. Where restoration is not possible prepare existing flooring to function as subflooring for carpet or vinyl flooring installation. Wood floors could be carpeted with a non-adhesive installation, if required by a tenant. The resultant finishes will offer a basic environment suitable for leasing, while historic finishes will be preserved "in situ." This action has already been taken on the first floor for wall surfaces.

Second, should tenants express a desire for more historic finishes, limited restoration of historic finishes could be considered. Exact restoration would not be cost effective, but a reasonable representation of the historic multi-chrome finishes could be achieved through careful selection of colors based on color analysis.

5. <u>Non-Leasable Space (basement or attic) - Building 1</u>

The first order of business would be repair of damaged surfaces, particularly plaster, cleaning, and refinishing where necessary. In the attic all painted plaster surfaces would be repainted to match existing colors.

6. <u>Leasable and Non-Leasable Space - Building 10</u>

The basic approach to finishes would be the same as in Building 1, but due to more extensive contemporary modifications in this building less historic fabric remains. Modifications to later partitioning would be acceptable to meet tenant requirements.

7. <u>Building 33</u>

Given the extensive fire damage the building interior can be modified to meet any requirements for a specific proposed use.

8. <u>Building 18</u>

Modify interior finishes as required for adaptive use.

HANDICAPPED ACCESS

IX. HANDICAPPED ACCESS

A. General

Buildings 1, 10, and 13 are the only structures which require significant modifications to achieve accessibility. Building 18 (garage) is currently accessible. Building 33 (gatehouse) has no proposed use, is isolated from the other structures, and is approximately 50 feet below the other park structures. To provide full accessibility for Building 33 would require significant site alterations which should be addressed further in the planning documents.

The major problem for Buildings 1, 10, and 13 is primary access to the first floor from grade. Once within the structures the first floor is accessible, with the exception of restrooms. The following discussion attempts to layout reasonable options for modifications to allow improved accessibility.

B. Arsenal, Building 13

1. Primary Access

Current handicapped access is via a wood ramp to the north side of the tower. The existing ramp is functional, but heavy in scale and does not meet handicapped design requirements for height of rails, diameter of rails, spacing of rails, and length of rails at the top and bottom of this ramp. Several options are available for providing the vertical lift necessary for access at the tower entrance.

Option 1. Replace the existing ramp with a new ramp lighter in scale and complying with accessibility standards for rails. This would reduce visual intrusion into the historic scene (see Illustration 120).

Option 2. Replace the existing ramp with a wheelchair lift. Either side of tower is feasible, with the south side being slightly more compatible with the industrial character of a lift. However, the lift would be visible as a visitor drives up to the Arsenal. Protection for the lift mechanism must be provided (see Illustration 120).

Option 3. Remove the 1945 loading dock, restore/reconstruct the first floor tower interior and doors, and install a lift within the tower (Carper, 1978; see Illustration 121). This would provide a well-protected location for the lift and restore one of the grander features of the Arsenal entrance. However, such construction is in conflict with the documented management goals, specifically maintenance of the existing historical continuum.

2. Interior Circulation

Door widths are adequate throughout the structure, but thresholds may require bevels. Vertical circulation to other floors via stairs or the existing freight elevator both of which require safety and handicapped modifications. Replacement of the existing elevator and reuse of the shaft is anticipated.

3. Restrooms

Current restrooms are not accessible based on ANSI standards for accessibility. Extensive modifications will be required, e.g., larger stalls, new fixtures, grab bars, etc., if the existing restroom locations are retained. New restrooms would be designed to meet standards.

C. Commanding Officer's House, Building 1

1. Primary Access

The major problem is access to the first floor from grade, a distance which varies from approximately 48 inches to 70 inches. This would require ramps approximately 53 to 75 feet long. Such a ramp will, by virtue of its size, constitute an intrusion into the historic scene. Wheelchair lifts would be feasible options, and would tend to be less intrusive than the ramps.

Two locations offer reasonable possibilities for access to the first floor level. Option 1 is a vertical access to the main house porch at the west steps and using the porch to get to the front entrance (see Illustrations 65, 66, and 122). A ramp would be required on the porch to get over the two risers up to house floor level. This option has the advantage of allowing handicapped access at the main entrance to the structure. If a ramp were used it would wrap around the west side of the house and start at the road circle in front of the house where handicapped parking would be located.

Option 2 is access onto the east wing porch and then circulation through the wing to get to the main house (see Illustration 123). A vertical lift could be installed at the stairs, as drawn. A ramp would circle the east wing and parallel the parking circle behind the house where handicapped parking would be located. The ramp would cover the existing deteriorated stone steps.

2. Interior Circulation

Door widths are adequate throughout the first floor, but thresholds would require bevels to be added. Access to the basement or upper floors by handicapped individuals would require installation of some form of lift, which would require significant alterations to the building fabric. With leased space the proposed building function, consideration of any interior lifts should wait until analysis of a specific tenants needs can be assessed.

3. Restrooms

Restrooms are of a conventional residential type, but generally small, narrow, and below handicapped standards. Room 116 offers the best opportunity to provide an accessible restroom in the house. A combination of Room 116 and 117 would allow construction of an acceptable unisex, accessible restroom. Construction would involve removal of historic fabric, probably dating from construction.

This restroom solution would complement the second primary access option, access at the wing, and provide another accessible restroom on site in addition to those to be provided at the Arsenal.

D. <u>Master Armorer's House, Building 10</u>

1. <u>Primary Access</u>

The major problem is the grade to first floor elevation change of approximately 32 inches, which requires a ramp length of approximately 40 feet. Such a ramp would constitute a major visual intrusion at the main entrance, therefore handicapped access at the back porch is preferred. The ramp could parallel the long axis of the building and be generally screened from the road and the majority of the historic site. A final decision should wait for identification of specific tenant needs.

2. <u>Interior Circulation</u>

Door widths are generally adequate, with only bevels for thresholds required. Provision of access to the basement or second floor would require a lift.

3. <u>Restrooms</u>

The existing first floor bathroom would require modification to meet accessibility standards. At a minimum, grab bars, hot water pipe insulation, and lower mounting heights for mirrors are required. The current bathroom does not provide adequate turning space, but modification of walls to include the wall closet would allow the space to be marginally acceptable. Specific tenant needs might alter requirements.

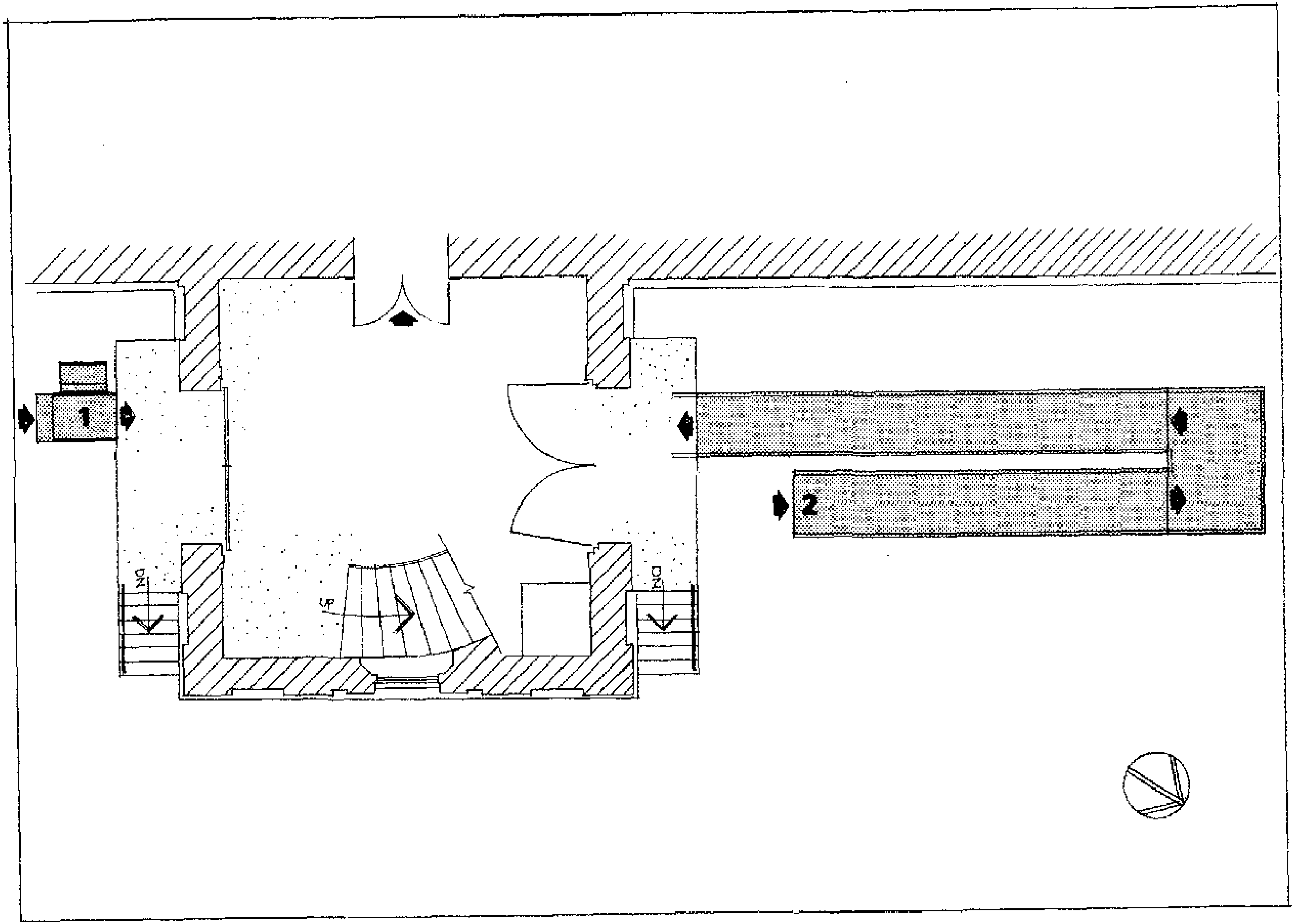

Illustration 120
Arsenal, Handicapped Access Option 1 and 2, Tower Entrance
Scale: 1/8" = 1' 0"

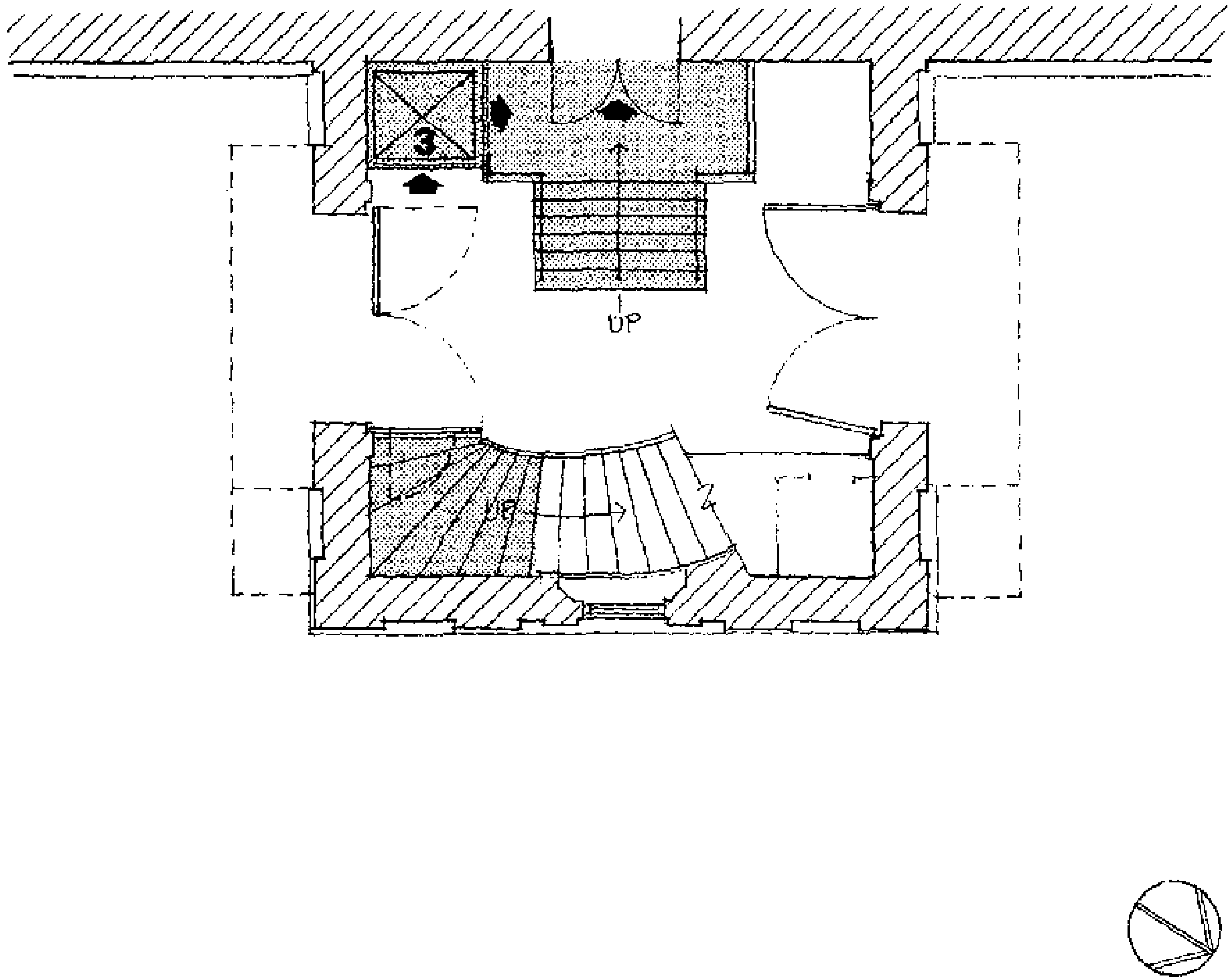

Illustration 121
Arsenal, Handicapped Access Option 3, Tower Entrance
Scale 1/8" = 1' 0"

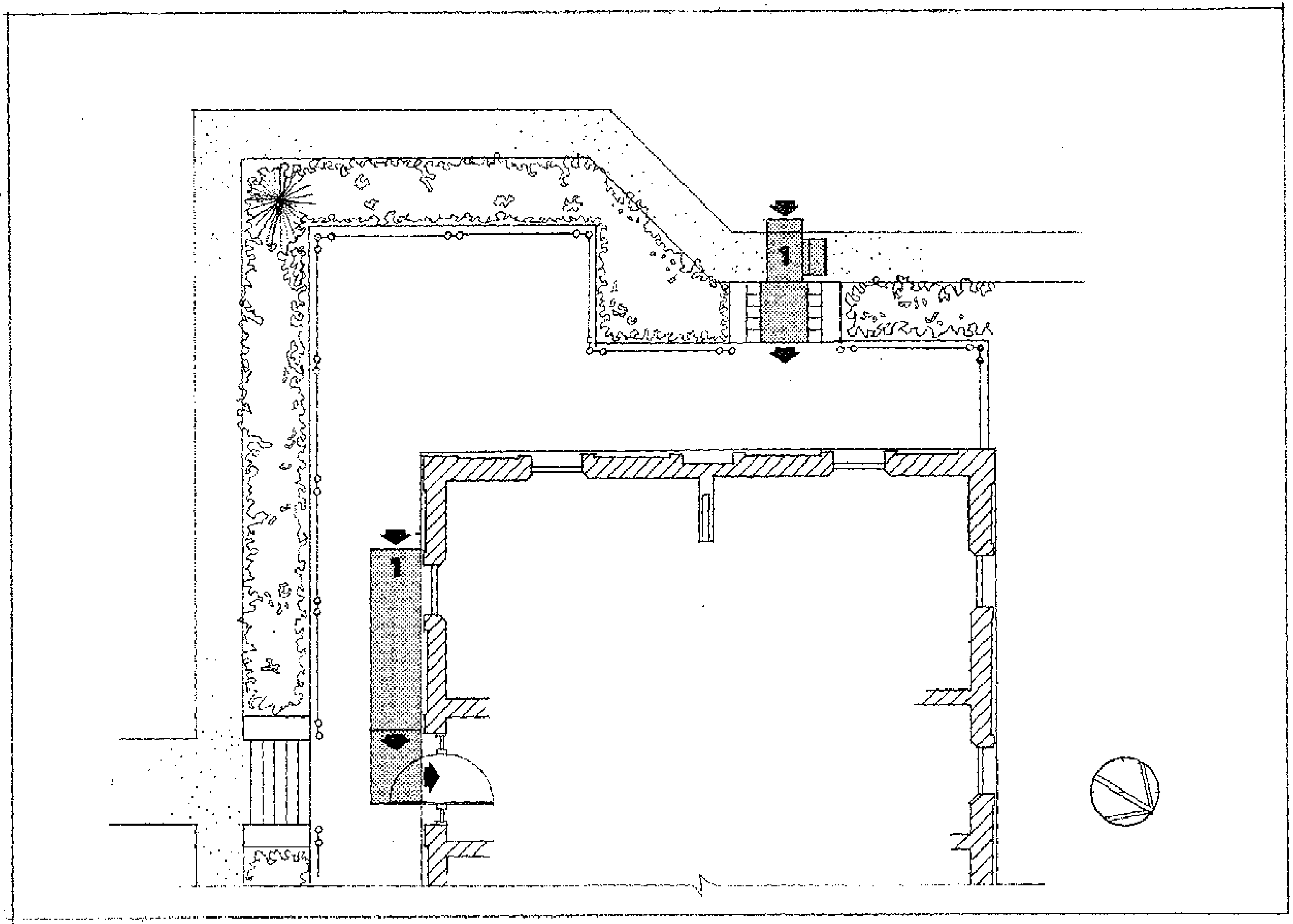

Illustration 122
C.O.'s House, Handicapped Access, Option 1, West Porch Entrance
Scale: 3/32" = 1' 0"

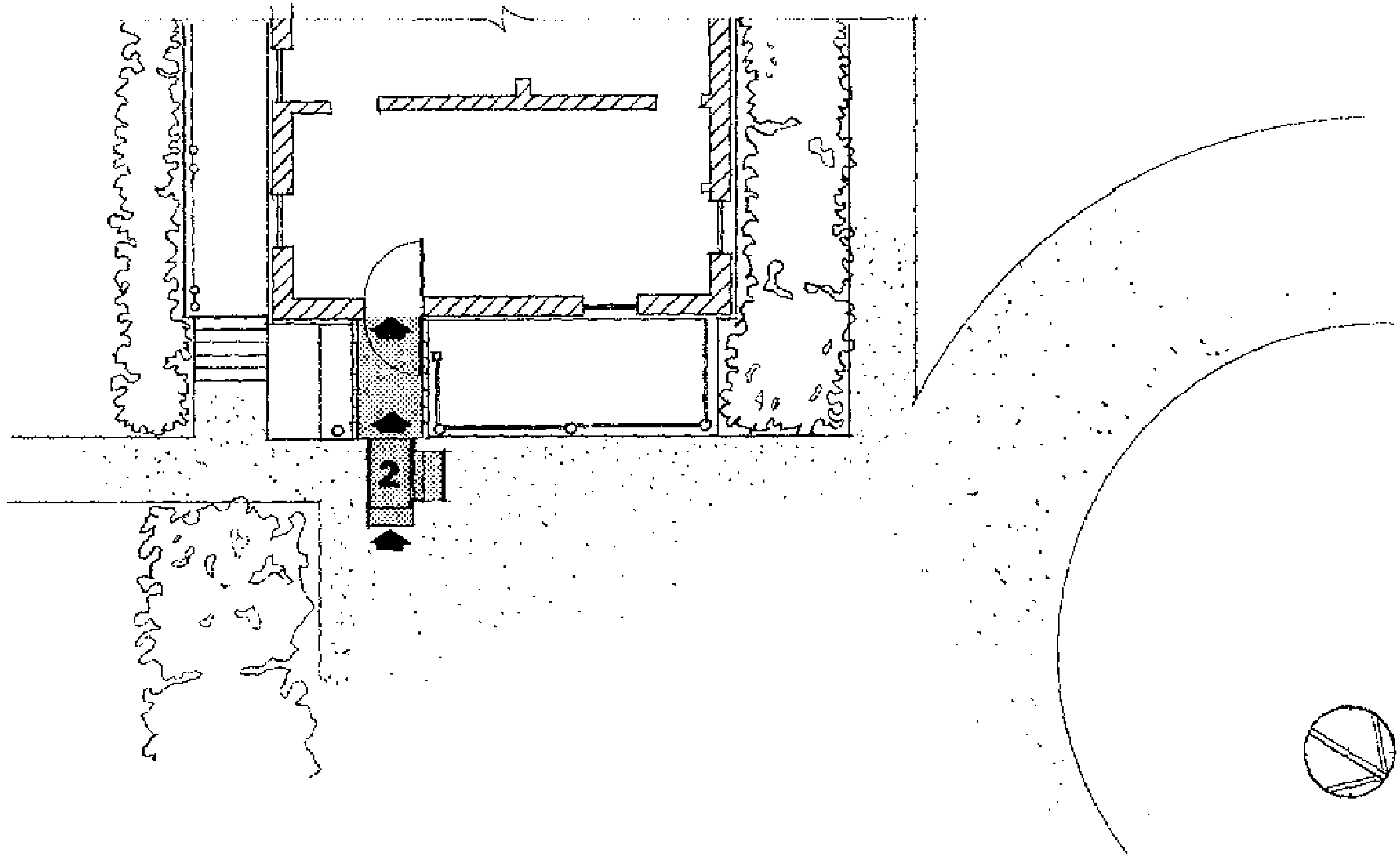

Illustration 123
C.O.'s House, Handicapped Access, Option 2, Wing Entrance
Scale: 3/32" = 1' 0"

CODE COMPLIANCE

X. CODE COMPLIANCE

A. General

As an entirely government-owned facility, code compliance requirements are set by government and NPS management policies. National Park Service policies require that in the preservation of historic structures, "every attempt shall be made to comply with local building and fire codes, to cooperate with local officials, and to provide protection from lightning."[1] For Springfield Armory the primary codes involved are the Life Safety Code[2] and the Massachusetts State Building Code.[3] The administrative officer for determining compliance for the Denver Service Center is the safety officer, who in conjunction with the regional safety officer makes a determination.

The following sections attempt to identify any major code issues and possible modifications required to comply with applicable building codes. Some code questions, specifically related to the adaptive use of the structures, will be deferred until the future when building uses and occupancies are more precisely defined.

B. The Arsenal, Building 13

1. Building Egress

The existing means of egress are inadequate, in that window exits are not panic operable. Modification of the existing exit sash on first and second floors to allow full height exit and panic operation would bring egress conditions into compliance. Egress from the basement requires additional exits on the east side, with sash modifications on all window exits to allow more rapid exit by park staff.

---

1. NPS Management Policies, p. V-26.

2. Life Safety Code, NFPA.

3. State Building Code, The Commonwealth of Massachusetts.

The exterior fire escapes, ladder and stair combination, are acceptable for limited occupancies, but should be inspected, repaired, and repainted. The DSC safety officer has accepted the following floor occupancies given the modifications discussed:

Basement - 10 persons
First Floor - 49 persons
Second Floor - 20 persons

The main tower stair is lacking a handrail on the outside of the curved stair and one should be added, particularly if the second floor is to be used for any interpretive uses. Design should be sympathetic to the historic scene.

2. Elevator

Installation of a new elevator in the existing shaft will require improved ventilation of the shaft to comply with code requirements.

3. Conservation Laboratory

The introduction of a new occupancy, laboratory functions using solvents, into the building will require enclosure by rated walls and other modifications to ensure code compliance. Separate mechanical and ventilation systems may be required for the laboratory space.

C. Commanding Officer's House, Building 1

The Commanding Officer's House exhibits no major code questions. The wing stair does have two winders, but given the structures status as a historic structure and limited occupancy, no physical alterations will be required.

D. Master Armorer's House, Building 10

The Master Armorer's House exhibits no major code questions. The main stair contains winders which violates the codes for new construction. Since the structure is historic and will have a limited occupancy, physical alteration will not be required.

BUILDING 10 - RELOCATION

BUILDING 10 - RELOCATION

The structure was built in 1833 northwest of the existing location of the Main Arsenal, Building 13. Building 10 was moved to its present location outside of the NPS-administered portion of the historic site by 1882.

When the historic site was created congressional committee reports[1] strongly called for relocation of Building 10 to its original location in the NPS-administered portion of the site. The cooperative agreement[2] with Springfield Technical Community College (STCC) was negotiated on that basis and provides for the STCC to demolish the structure after giving the National Park Service proper notice and after the National Park Service would fail to move the structure. This clause was included to ensure STCC the right to develop its own physical plant.

During the design concept planning process, NPS management determined that if Building 10 could be preserved on its existing site, that it would be the most beneficial solution. Relocation to its original site raises many questions concerning period of restoration. Analysis of the proposed STCC building construction and discussion with STCC management has resulted in a general agreement that Building 10 can remain where it is. The National Park Service has entered into renegotiation of the cooperative agreement with STCC to formalize the Building 10 solution.

However, should management determine at a future date that Building 10 should be relocated several issues would remain to be addressed. Relocation of the house to its original site would preserve the structure but create a non-historic scene. This would create an ambiguous situation requiring interpretation to resolve.

---

1. See Appendix E.

2. See Appendix F.

Historic maps show the location to have been between 90 and 105 feet northwest of Building 13 with its front facade aligned with the main facade of Building 13 or possibly within 2-1/2 feet toward the street from that alignment.[3] Prior to relocation, archeological investigations would be required to determine the exact location and the extent of any remaining portions of its original foundations. The design of new foundations might be influenced by remains of the original.

Since the building has interior bearing walls, new foundations to support them would be required, but there are alternative designs:

> Alternative A - A full basement, matching the existing, with a concrete slab floor, rubble stone walls to approximately 4 inches below finished grade level, and brick above that level.
>
> Alternative B - A full basement, similar to the existing, with a concrete slab floor, concrete foundation and walls, with brick above grade on the exterior.
>
> Alternative C - A partial basement for mechanical equipment with the remaining areas as crawl space, concrete footings, and foundations with brick above grade on the exterior.

The exterior appearance of the building would have, and must have, the same appearance in any case. Reconstruction of the entire basement in its existing form would preserve the integrity of the entire building and would provide more usable space. This would be the most costly alternative.

The existing stone and brick walls do not necessarily exhibit the original appearance although original materials may have been reused. The basement has no intrinsic value for interpretation.

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3. See Drawing No. 458/28003, Sheet 1 of 15.

Constructing a full basement of concrete, (Alternative B), would preserve the entire space but not the appearance. Usable space would still be provided at less cost than Alternative A.

Alternative C would provide basement space for mechanical systems and perhaps some storage. This should be under the rear section of the house utilizing the historic exterior and interior stair locations for access. Access to crawl spaces under the front section of the house should be at the locations of existing interior openings. This would be the least costly alternative.

Factors which may influence the choice of alternatives are the types of mechanical systems used, the extent of excavation required for placing the structure, and the space use requirements. If one or more of these factors do not dictate a full basement, Alternative C is recommended.

Determination of existing utility locations and new utility locations and service will be required. The moving route, along the existing road, has adequate space to clear existing vegetation but signs, electric lamp posts, storm drain drop inlets, and fire hydrants will need to be temporarily removed or protected. Missing knee braces in the attic framing of the main house should be replaced and all framing checked prior to a move.

APPENDIX A

CHRONOGOLOICAL SUMMARY OF HISTORIC DATA

APPENDIX A: CHRONOLOGICAL SUMMARY OF HISTORIC DATA

The information in this appendix is from the Historical Data Section, Historic Structure Report and Historical Base Map, Springfield Armory National Historic Site, Massachusetts, by John Albright, Denver Service Center, National Park Service, May 1978.

Dates	Report Reference	Event
Chapter II		
1825	p. 14	Roswell Lee attempted to solve erosion problems on the bluff, carrying out grading and drainage.
1831	p. 14	Additional land acquired (at the ravine). Other structures at the Armory had been built. Schoolhouse (north of the ravine) had had an addition.
c. 1825-31	p., 16	Development of landscaping. Roswell Lee developed plan for the Armory which was basis for Lt. Col. James W. Ripley's construction program.
1833	pp. 16-17	Lee initiated construction of Master Armorer's residence, Building 10, and the Paymaster's residence, Building 17. These flanked the original Commanding Officer's Quarters, which was on the site of the later Main Arsenal.
1834	p. 17	Some buildings painted ordnance colors (salmon). (The Whittlesey reference, 1920, indicated this color still existed in 1920 but may have been buildings other than those in the national historic site.)
1835	p. 17	Inspection report indicated need for repairs on residences.
Chapter III		
1841-54	p. 19	Tenure of James W. Ripley as superintendent, (civilian), then as military officer (commanding).

Dates	Report Reference	Event
1843	pp. 23-24	First commanding officer's (superintendent's) house demolished. Ripley initiated additional land acquisition (north and west sides of Armory site), and his development plan.
1845	p. 24	Evacuation begun early in year for new Commanding Officer's House (Building 1).
(1842)	p. 25	(Reference indicates Paymaster's, Master Armorer's and four clerks houses had been built since 1834.)
1845	p. 26	Two outbuildings associated with old commanding officer's house moved to north side of Armory Square, by early June. Construction of 30,000 gallon cistern between new and old commanding officer's quarters (brick lining with iron cap; remained until at least 1920), with water supply line to new Commanding Officer's House. Construction of new Commanding Officer's House underway in fall. Grounds improvements.
1846	p. 26	City realigned and widened State Street adding land to Armory.
1847	pp. 26-27	Excavation in spring of year for construction of Main Arsenal (Building 13). Continuing site work.
1847	pp. 27-28	Commanding Officer's Quarters nearing completion--"slating" and "Orcutts patent lightning conductors." Beginning of construction of iron fence.
1845-50	pp. 28-29	Installation of flagstone walks and landscaping (1845-50). Stone foundation for fence started along State Street, (1847). Red sandstone from Longmeadow. Patterns for fence (9 feet high) and gate not approved by Ripley until 1852. Palings described as "round with spear heads" alternating with "lobed with pikes heads."
1849	pp. 29-30	Main Arsenal nearly ready for roofing; clock placed in tower; ready for reception of gun racks.

Dates	Report Reference	Event
1850	pp. 30-31	Continuation of grading. Completion of new culvert east of and parallel to new arsenal.
1850	p. 31	New Main Arsenal, Building 13: tower and roof finished; cellar paved; exterior walls oiled; copper electrical conductors (lightning?) installed; lathing and plastering completed (9,000 superficial yards); gun racks being built.
1850	p. 32	Street lamps and flagstone walks installed around principal square.
1850	pp. 32-33	Interior finishing Building 13, continued. Second floor gun racks completed with capacity of 92,176 muskets. Workers brought in 66,981 percussion muskets. Carpenters were building gun racks for third floor.
1850-51		Painters continued interior work.
1851		Third floor gun racks advancing toward completion.
1851	pp. 33-34	1851 maps show the "Green" changed to "Tower Hill," landscaping is formal whereas grounds west of square have natural, informal arrangement.
1851	pp. 35-39	Maps show rose arbor circle behind Commanding Officer's House; walks around that and circle in front of house. Main entrance at State Street where intersection occurs with road on east side of Main Arsenal. Gardens or farming plots appear northwest of Commanding Officer's House. Possible rectangular paved areas in front of Building 13 shown on 1851 map. Walk and drive from Commanding Officer's House to street, northwest of Master Armorer's House.

Dates	Report Reference	Event
1852	pp. 39-40	Casting of fence begun. Another mention of fence foundations along State and Byers streets. State Street fence completed. Gas line laid around square for lighting of buildings. (Whether lighting installed in Buildings 1, 10, or 13 is not mentioned.) Water lines installed and extended to three residences at west end of Square--possibly to Commanding Officer's, Master Armorer's, and Paymaster's houses. Public buildings and Commanding Officer's House painted. Gun racks on third floor of Main Arsenal completed and partially filled with guns.
1853-54	p. 40	Inspection report of 1853 contained notation that nearly all buildings had been painted on the exteriors a uniform color.
	pp. 43-45	New Arsenal intended to contain 300,000 muskets (100,000 each floor).
Chapter IV 1856-57	p. 48	Grading of slope southwest of the Main Arsenal. Stone foundations for fence set along Byers Street, then along Pearl Street. Drainage culverts laid along Pearl Street. Trees and hedges planted.
1860	p. 48	Byers Street fence completed, Pearl Street fence begun.
1862	pp. 48-50	Fence completed around Hill Shops.
1864	pp. 50-55 and Map 8	Map of Springfield Armory, April 1864, shows: (a) garden and landscaped circle drive north of Commanding Officer's House, (b) ice houses, one north of Commanding Officer's House and one south of Master Armorer's House, (c) delineation of "yards" with hedges around Master Armorer's House and Paymaster's House, (d) utilities, and (e) topography. (The water line to the Commanding Officer's House had been installed in 1845, one to the Master Armorer's House in 1852.)

Dates	Report Reference	Event
c. 1870-75	p. 60	Main gate moved to corner of State and Byers streets and new road built from gate up hill to a point near the Paymaster's House. Pool at base of hill near Pearl Street has fountain.
c. 1875-76	pp. 60, 64	New gatehouse built at State and Byers streets entrance. Old State Street entrance gate replaced with fence but pedestrian gate remained.
1876	pp. 64, 66	Centennial or Civil War memorial erected at new entrance road south of Paymaster's House.
c. 1877	pp. 64-68 (Map 10, 1877; Illus. 8, c. (1876)	As of this date, Paymaster's House had undergone some changes; Commanding Officer's House still had original porches; another fountain added behind Commanding Officer's House.
1877-82	p. 67	Master Armorer's House (Building 10) moved during this period.
c. 1884	p. 72 (Illus. 11)	Original porches still shown on Commanding Officer's House.
1885-1900	pp. 70, 74	Utilities improvements (lighting and water) during this period. In 1892 post was still lighted by gas and building water service was by gravity from tanks on top of "public" buildings. In 1892, the fence was described as being finished with black paint.
1882	p. 69 (Map 11)	Map shows Building 10 in its present location and it retained the rear section, which is now gone.
1895	pp. 75-76	Paymaster's House (front section) moved to north side of the quadrangle.
1882-99	p. 76 (Map 12)	New road built behind Main Arsenal. 1899 map shows Building 10 without rear section.
	p. 77	
1897	p. 98	Hydraulic (water-powered) elevator installed in Main Arsenal (Building 13).

Dates	Report Reference	Event
1900-15	pp. 76-78	Installation and modification of water, sewer, gas, and electric utilities.
1902	p. 76	City water installed by July 1, (replacing spring water source), to Commanding Officer's House and Building 10 (then used as a hospital). Fire hydrants installed for the Armory.
1904	pp. 76, 78 Map 13, p. 79	Map of this date shows two greenhouses at ends of garden north of Commanding Officer's House. Spring water still used to supply some buildings. New roadway and walks at front and to northwest of Main Arsenal.
1906	p. 78	Buildings now had steam heating, supply from central steam plant. Electric light plant and gas generator served site, 8 inch water line installed connected to city line in State Street.
1908	p. 78	The present gatehouse (Building 33) replaced the 1875-76 gatehouse.
1910	p. 78	Electric grounds lighting installed. Some modified in 1915 for arc lights.
1912-13	p. 98	Fire sprinkler system installed in Main Arsenal (Building 13).
1932	p. 83; Illus. 14, p. 84; Illus. 15, p. 86; Illus. 18, p. 95.	By this year the tennis court west of Building 13, and rose arbor in circle behind Building 1 were in place; greenhouses had been modified. A pool between Buildings 1 and 13 had been built. Building 10 still had chimneys and shutters and entrance portico was enclosed.
1937	p. 83	Garage, Building 18, built and repairs made to Master Armorer's House, Building 10. Both projects were probably WPA. Buildings were sandblasted, removing paint from brickwork.
1940-41	p. 98	Loading dock built in base of tower, Building 13, and new (the existing) elevator installed.

Dates	Report Reference	Event
1958	p. 87	Greenhouses had been removed.
1964		Pool between Buildings 1 and 13 gone.
1968		Grounds graded for school football practice fields, west of Main Arsenal and the garden.

APPENDIX B

STULL ASSOCIATES' REPORTS

APPENDIX B

As support for the production of contract documents an architectural engineering (A/E) firm prepared five preliminary design reports. The A/E design team was composed of the following firms:

1.	Stull Associates, Inc. 100 Boltston Street Boston, Massachusetts 02116	Prime contractor Architecture
2.	Building Conservation Technology, Inc. Suite 1117 1010 Vermont Avenue, N. W. Washington, D. C. 20005	Subcontractor Historic Preservation
3.	R. G. Vanderweil Engineers, Inc. 52 Chauncy Street Boston, Massachusetts 02111	Subcontractor Engineering
4.	Zaldastani Associates, Inc. 7 Water Street Boston, Massachusetts 02109	Subcontractor Structural Engineering

The A/E's involvement with Springfield Armory National Historic Site dealt with the first two phases of construction and the preliminary design to support that work. The Carper draft historic structure report was used as the basic document establishing assumptions concerning future use. This resulted in occasional references to proposed use which had not been selected by management, e.g., removal of the Building 13 loading dock.

Phase I - Exterior Stabilization, Building 1 and 13; Construction FY 80

Phase II - New Heating and Electrical Systems, Building 1 and 13; Construction FY 81 and 82

Excerpts of the preliminary design reports are included in this appendix to supplement the initial Carper report. The materials not included in the excerpts are technical calculations, equipment specification, paint layering charts, estimate work sheets, and existing conditions text and photographs which is adequately covered by the revised text. Only excerpts are included with the goal of keeping the document size manageable, and therefore usable. Complete copies of each report are located at the following sites:

National Park Service
Denver Service Center
Technical Information Center
P. O. Box 25287
755 Parfet Street
Denver, CO 80225

Rocky Mountain Regional Office
Library
P. O. Box 25287
655 Parfet Street
Denver, Colorado 80225

Springfield Armory National Historic Site
1 Armory Square
Springfield, Massachusetts 01105

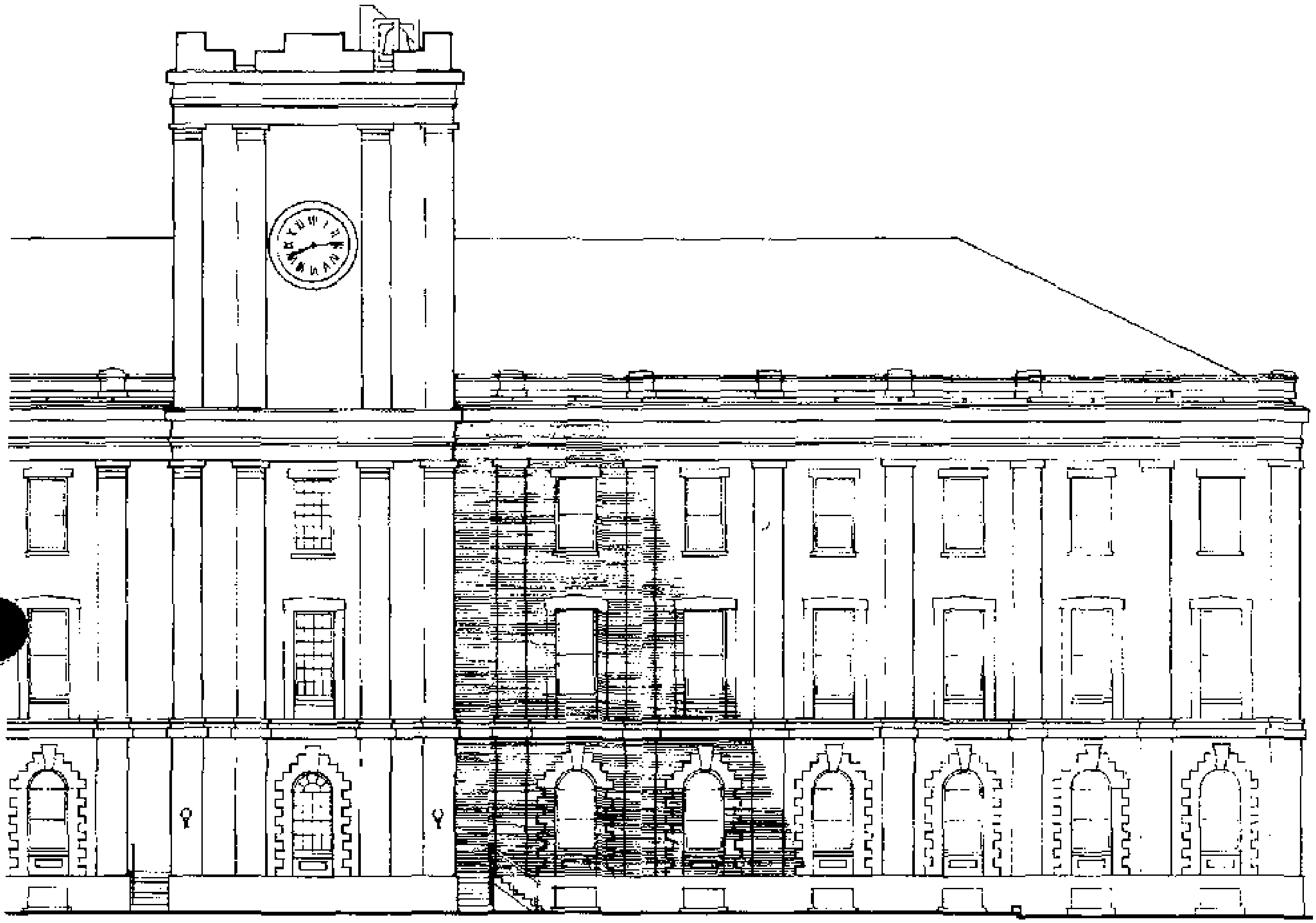
North Atlantic Regional Office
National Park Service
15 State Street
Boston, Massachusetts 02109

National Park Service
U. S. Department of the Interior
Historic Architecture Division-408
Washington D. C. 20240

APPENDIX B-1

BUILDING SYSTEMS ANALYSIS AND RECOMMENDATIONS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE



BUILDING SYSTEMS ANALYSIS AND RECOMMENDATIONS

prepared for the
National Park Service
by
Stull Associates, Inc. and
R.G. Vanderweil Engineers, Inc.

BUILDING SYSTEMS ANALYSIS AND RECOMMENDATIONS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

Main Arsenal
Commanding Officer's House
Garage
Gatehouse

prepared for the
National Park Service
Basic Agreement No. CX-2000-8-0044
Work Directive No. 8-0044-78-01

March 6, 1979

by
Stull Associates, Inc.
431 Marlborough St., Boston, Massachusetts

and
R.G. Vanderweil Engineers, Inc.
52 Chauncy St., Boston, Massachusetts

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H. Heating Plant Cost Estimates

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1. INTRODUCTION AND SUMMARY

1. INTRODUCTION AND SUMMARY

1.1 BACKGROUND

The Springfield Armory National Historic Site is composed of four buildings: Building 1, the Commanding Officer's House; Building 13, the Main Arsenal; Building 33, the Gatehouse; and Building 18, the Garage. Building 10, the Master Armorer's House, may be moved onto the historic site shortly but was excluded from the study. Refer to Figures 1-5.

The two main buildings (#1 and 13) date back to the 1850's and are presently utilized for office and exhibition space. A TV station located in the basement of the Arsenal will be vacating within the year. The National Park Service plans to renovate the buildings, expanding exhibition space and opening areas to community groups. A section of the Arsenal will be adapted for curatorial treatment of the gun collection now stored and exhibited there.

The expanded use and restoration of the buildings will require major changes, especially in the heating and cooling systems. Additional lighting and plumbing services will also be necessary to meet anticipated increases in public use. R. G. Vanderweil Engineers was retained to evaluate and define these building system changes.

1.2 SUMMARY OF RECOMMENDATIONS

Results of the analyses are a lengthy series of recommendations and alternatives for each building. These recommendations are summarized in Table 1. The extent of improvements necessary will depend upon the building usage program determined by the Park Service.

Cost figures have been escalated to December 31, 1981 dollars but do not include Architect/Engineer fees. Estimates are based upon the following factors: 15% special handling allowance, 15% scope refinement allowance, 10% sub-contractor's overhead and profit, 10% general contractor's markup, 5% contingency and 1% per month escalation to December 31, 1981 - for a total of 117% over the base materials and labor cost.

Comments on the historic value of the existing building systems are given after the system descriptions throughout the text. A summary of historically significant items is shown in Table 2.

The building structures were analyzed for compliance with ASHRAE Standard 90-75 and installation of storm windows and insulation was recommended where necessary for compliance; refer to Table 3. Other energy-related modifications, such as use of fluorescent lighting, will need to be considered when HVAC and lighting systems are designed.

In general, the building systems are adequate for existing purposes with only minor adjustments; however, the NPS program for future use of the building necessitates extensive modifications. Lighting and HVAC systems will be significantly modernized under this program. Plumbing, fire and lightning protection, and security are basically adequate and need only minor repairs or expansion. The electrical service to the buildings should be replaced to provide an adequate and safe power supply.

Several heating, ventilating, and air conditioning (HVAC) systems were considered for the Arsenal and the Commanding Officer's House; these options are discussed in detail in Sections 2.4.1 and 3.4.1. The most cost effective HVAC system for the Arsenal, and therefore the system recommended, consists of decentralized air handling units with steam heating and chilled water cooling coils and a below-grade cooling tower for condensing. (Refer to the life cycle analysis in Section 3.4.1 and Table 4.)

Evaluation of HVAC systems for the Commanding Officer's House was based upon the appropriateness of the system for the historic integrity of the building, rather than life cycle cost analyses. Adaptation of the historic gravity hot air system for heating and cooling is therefore recommended. Modifications to the existing systems would include installation of three two-speed fans (for winter/summer air flow requirements) and filter units, one for each heating chamber. Return air grilles and ducts would be located in the first level floor near the air intakes for the existing heating chambers.

Several systems for steam heat generation were also evaluated: (1) a central boiler plant in the Commanding Officer's House with new underground steam and condensate piping to the Arsenal (and Building 10 if it is relocated), (2) one fossil fuel boiler in the Commanding Officer's House and two fossil fuel boilers in the Arsenal with restoration of a chimney in the Arsenal roof, and (3) a fossil fuel boiler in the Commanding Officer's House and two electric boilers in the Arsenal. Solar heating systems were evaluated but proved not to be cost-effective; results are shown under the appropriate sections.

As shown in the life cycle cost analysis summary in Section 6.2, Table 8, the most cost-effective system combination is a gas-fired boiler in the Commanding Officer's House (dual fuel burners recommended) and two electric boilers in the Arsenal (two for reliability). It should be noted that the analysis is based on current power company rate schedules, shown in Appendix M; under the electric rate schedule 35, electric cost is roughly 2 to 3 cents per kilowatt-hour. This cost appears quite low and, when the system is finally designed, utility costs should be verified before a final decision is made to proceed with the installation of electric boilers.

1.3 REPORT FORMAT

The report is divided into six sections - one on each building, one on site utilities, and one summarizing the recommendations - and several appendices providing background material and calculations. For clarity and simplification, each individual building section was arranged in the following manner: (1) general building description, (2) description of building systems - with discussions of each electrical or mechanical system, its historic value and the feasibility of the continued use of the system, (3) building skin improvements necessary to comply with energy conservation standards, and (4) building system improvements necessary for or applicable to the future use of the building as outlined in the Historic Structure Report (NPS, Robert L. Carper). Routing of system elements is covered under item 4.

TABLE 1: SUMMARY OF NEEDED IMPROVEMENTS

		COST (1981)[1]	
EQUIPMENT OR ACTION		RECOMMENDED IMPROVEMENT	ALTERNATIVE MEASURES
ARSENAL (Building 13)			
1.	Interior wood frame storm windows	$ 73,900	
2.	2-1/2" fiberglass batt roof insulation		
	- on floor	7,600	
	- between joists		$ 8,200
3a.	Decentralized air handling units (AHU's) with DX coils and water cooled condensers		551,300
3b.	Decentralized AHU's with chilled water cooling	624,800	
3c.	Fan coil units with interior AHU on each floor		735,000
3d.	Free standing air conditioning units with air cooled condensers		558,000
4a.	Fossil fuel boilers -gas		94,200
	-oil		104,200
4b.	Electric boilers	79,100	
4c.	Solar heating system		291,000
4d.	Solar domestic hot water system		8,900
5.	New restroom fixtures and piping	60,000	
6.	Clean/repair downspouts and underground drains	7,800	
	Allowance for examination of sub-surface drains	5,600	
7a.	Halon fire protection in curatorial areas only, sprinklers elsewhere		51,500
7b.	Complete halon system	947,600[2]	
7c.	CO_2 system (attic and 3rd floor), halon elsewhere		847,900
7d.	Halon (basement to 3rd floor), sprinklers in attic		810,100
8a.	Security system for third floor areas[3]		6,700
8b.	New security system for basement, 1st and 2nd floors	46,900	
8c.	Closed circuit TV for 1st floor	15,400	

TABLE 1 (continued):

EQUIPMENT OR ACTION		COST (1) RECOMMENDED IMPROVEMENT	ALTERNATIVE MEASURES
9.	Arsenal lighting system	$122,300	
10.	New electrical service	150,100	
11a.	New electric passenger elevator		$27,800
11b.	New electric passenger elevator, historically correct	33,300	
11c.	Shaft modifications and 4 new entrances	50,000	
12.	Allowance for phone line relocation	600	
13.	Curatorial electrical and mechanical systems	17,800	
14a.	100 KVA emergency generator for boiler backup - gas		40,700
	- oil		54,800
14b.	25 KW emergency generator for elevator backup		9,100

ARSENAL - TOTAL RECOMMENDED MODIFICATIONS
- with Halon fire protection (7b) $2,242,800
- without complete Halon system (7a) 1,346,700

COMMANDING OFFICER'S HOUSE (Building 1)

		RECOMMENDED IMPROVEMENT	ALTERNATIVE MEASURES
1a.	6" fiberglass batt roof insulation between joists		3,600
1b.	6" insulation in floor, add doors to attic and roof	6,100	
2.	Upgrade historic heating system for future use.	13,300	
3a.	Modify existing heating system for cooling	16,900	
3b.	Window air conditioning units		10,100
3c.	Portable window air conditioning units and modifications to existing wing system		13,100
3d.	Fan coil units for cooling		56,300

TABLE 1 (continued):

EQUIPMENT OR ACTION		COST(1) RECOMMENDED IMPROVEMENT	COST(1) ALTERNATIVE MEASURES
4a.	Fossil fuel boilers - gas	28,200	
	- oil		32,200
4b.	Solar heating system		123,600
4c.	Greenhouse solar heating system		127,300
4d.	Solar domestic hot water system		5,720
5.	Repairs to existing plumbing	1,100	
6.	Replacement of plumbing drains and traps(3)		5,600
7.	Clean downspouts	1,100	
8.	Heat detectors in attic and boiler room; exterior fire alarm/light	6,700	
9.	Complete security system	5,000	
10.	Allowance for interior lighting fixtures	8,300	
11.	New concealed electric service	21,400	
12.	Allowance for phone line relocation	700	
COMMANDING OFFICER'S HOUSE - TOTAL RECOMMENDED MODIFICATIONS		$ 108,800	
GATEHOUSE (Building 33)			
1.	Double-glazing	$ 400	
2.	2-1/2" fiberglass roof insulation	100	
3.	Electrical service, lighting and telephone	4,400	
GATEHOUSE- TOTAL RECOMMENDED MODIFICATIONS		$ 4,900	

TABLE 1 (continued):

EQUIPMENT OR ACTION	COST (1) RECOMMENDED IMPROVEMENT	COST (1) ALTERNATIVE MEASURES
GARAGE (Building 18)		
1. Double-glazing	$ 200	
2. 3" fiberglass roof insulation and sheet rock ceiling	500	
3. 1-1/2" urethane foam wall insulation with sheet rock	1,100	
GARAGE - TOTAL RECOMMENDED MODIFICATIONS	$ 1,800	
SITE UTILITIES		
1a. Central heating plant, gas fired		$ 157,500
1b. Central solar heating plant		419,900
2. Energy management system		111,100
SITE UTILITIES - TOTAL RECOMMENDED	0	
GRAND TOTAL RECOMMENDED MODIFICATIONS		
- with complete Arsenal Halon system	$2,358,300	
- without complete Halon system	$1,462,200	

(1) Costs escalated to December 31, 1981. Architect/Engineer fees excluded.

(2) Recommended if budget allows; otherwise option 7a is recommended.

(3) Not recommended for present plans.

TABLE 2: SUMMARY OF HISTORIC ITEMS

ARSENAL

Steam heating pipe grids in basement
Black iron water service pipes
Sprinkler system
Lightning protection system - air terminals
Transformers and electric service equipment

COMMANDING OFFICER'S HOUSE

Heating systems
Lavatory in room 208
Bathtub in room 214
Lead waste piping and traps
Lightning protection air terminals on roof
Gas lighting outlets (rooms 120, 205, 209, 210)
Overhead electric cord incandescent (room 302)
Pull chain and rotary key switch incandescents
Exposed electric wiring on porcelain insulators (room 304)
Wood surface raceway and rotary snap switch (stairway 301)
Wooden panelboard with asbestos lining and porcelain Edison base fuse holders (room 305)

TABLE 3: TRANSMITTANCES (Btu/hr-°F-sf)

	ASHRAE REQUIRE-MENT	EXISTING STRUCTURE	EXISTING TRANSMIT-TANCE	PROPOSED TRANSMIT-TANCE
ARSENAL				
roof/attic	0.074	slate on wood	0.222	0.073
wall	0.27	4" face brick, 24" common brick, & plaster (29,400sf); windows (4,658sf)	0.317	0.240
C.O.'S HOUSE				
roof	0.074	slate roof on wood, plaster ceiling; skylights	0.350	0.072
wall	0.27	16" brick (main), 12" brick (wing), plaster; DG windows	0.270	0.270
GATEHOUSE				
roof	0.074	slate on wood & plaster ceiling	0.338	0.073
wall	0.27	8" brick	0.600	0.504
GARAGE				
roof	0.074	built up roofing on wood & plaster ceiling	0.329	0.071
wall	0.27	8" brick & plaster walls	0.77	0.25

2. MAIN ARSENAL

2.3 BUILDING SKIN IMPROVEMENTS

2.3.1 WINDOWS AND WALLS

Building skin improvements were evaluated in order to bring the overall heat transmittance of the buildings within limits specified by the ASHRAE 90-75 requirements. The combined transmittance of present walls, windows and doors at the Arsenal building is 0.32 Btu/hr-°F-sf. The ASHRAE Standard specifies an overall transmittance of 0.27Btu/hr-°F-sf for buildings under four stories, for annual conditions of 6,200 degree-days of heating (as experienced at Springfield).

Improvement of the building skin to meet ASHRAE standards would involve the installation of either (1) wall insulation or (2) double-glazing, reducing the overall wall transmittance to 0.24 Btu/hr-°F-sf. The first option, wall insulation, has been eliminated due to the construction of the wall structure and the desirability of maintaining the interior wall surface. The second option, double-glazing, will facilitate humidity control in the winter time and help prevent condensation on the windows.

Installation of ultraviolet-filtering films or the use of shades with the double-glazing should be considered. Ultraviolet light is deleterious to artifacts, causing fading.

Another alternative is the installation of storm windows. Special order storm windows could be manufactured with a simple wood frame and one full-sized pane of glass (or possibly lucite). The installation of storm windows reduces the infiltration of outdoor air and moisture (which will thereby lower energy costs). First and second floor storms would not be removed since the building will be air conditioned and humidified year round. Removable storms may be desirable on the third floor windows to allow summer ventilation, as third floor areas will not be air conditioned according to present plans.

Another (remote) possibility would be the installation of an interior glass enclosure for all museum spaces, which would create a glass "house within a house" for each floor, just inside the Arsenal walls.

The air space between the glass walls and the existing masonry walls would not be heated, and the overall effect would be equivalent to double-glazing. (This air space could be used as a passage way.) Humidity and temperature control would be more easily maintained, since outdoor conditions would have less influence.

Estimated heat transmission losses of 497 x 10^6 Btu/yr could be saved by the installation of double-glazing, lowering expected energy costs by as much as $1,790 annually.[1] Cooling costs would similarly be reduced by $120 per year, an energy savings of 34 x 10^6 Btu. Installation of special order storm windows is estimated to cost $73,900. With total savings of $1,910, the present value of savings (at 10% discount, 8% differential inflation rates) is $44,060, yielding a savings-to-investment ratio of 0.6. Discounted payback period is beyond the 30-year lifetime. A more cost-effective solution would be the installation of regular aluminum storm windows but these are considered incompatible with the historic integrity of the building.

2.3.2 ROOF IMPROVEMENTS

The existing roof/attic spaces have a combined transmittance of 0.222 Btu/hr-°F-sf. In order to conform with the ASHRAE 90-75 requirement of 0.075 Btu/hr-°F-sf, installation of insulation with an R value of 9 will be required.

Installation of fiberglass batt insulation on the underside of the roof structure would permit use of the attic space for storage. If use of the attic space is not required, however, installation of insulation on the attic floor is recommended to reduce costs. Installation of louvers to ventilate the attic will be necessary. An estimated 371 x 10^6 Btu's of heating energy can be saved annually by this measure. At a fuel oil cost of $0.40 per gallon, this will amount to savings of approximately $1,340 per year. Installation costs are expected to be $7,600, yielding a discounted payback period of 6 years.

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(1) Given oil heating value of 148,000 Btu/gal, generating & distributing efficiency of 75%, and oil cost of $0.40/gal.

2.4 BUILDING SYSTEM IMPROVEMENTS

The Arsenal building is presently used as a museum, exhibiting and storing the historic gun collection. Programmatic assumptions are based on the draft Historic Structures Report. The present main floor exhibition will be upgraded and possibly expanded to the second floor as well. Collection storage will remain on the second floor with potential expansion to the third floor; study areas could be located on the second floor. The basement areas will be upgraded to provide library, office and workshop space. A section of the basement has been allotted for mechanical equipment. Rest rooms will be installed on each floor.

Building system modifications specified in this section are based upon the functional changes proposed above and the following assumptions:

(1) Estimated peak occupancy levels of 80 people in the exhibit areas, 20 staff members in office, library and workroom spaces, and 8 people in the second floor storage and research areas (according to the Park Service data).

(2) Interior environmental conditions of 72°F and 30% humidity in the winter and 72°F and 50% humidity in the summer.

Recommended humidity levels for museum artifacts are 45 to 60% relative humidity for wood and up to 30% for metal.[1] The choice of 30% winter and 50% summer humidity was made to minimize the difference in humidity between interior and exterior to avoid condensation problems in the winter and damage to the building fabric. A constant interior temperature of 72°F was chosen as a compromise between summer cooling and winter heating.

In order to retard the aging of the artifacts due to environment, certain constraints are desirable. There is no universal agreement on precise environ-

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(1) Protection of Cultural Properties During Energy Emergencies, ed. Dr. Robert A. Matthai; 1978 Arts/Energy Study and American Association of Museums.

mental conditions, but it is generally acknowledged that the following three environmental criteria should be met in museums:

(1) Exposure of artifacts to ultraviolet radiation should be minimized to prevent photochemical deterioration (fading).

(2) The environment should be relatively free of particulates and gaseous contaminants such as sulfur dioxide (which can react with moisture and oxygen to form sulfuric acid).

(3) The temperature and relative humidity should be maintained fairly constant on a 24 hour per day basis to prevent expansion and contraction.

The ultraviolet criterion is usually met by avoiding direct impingement of sunlight on artifacts, and by filtering diffuse sunlight that is allowed to enter the gallery. Filtering can be achieved by adding UV absorbants to clear acrylic and PVC plastics. Such filters tend to lose efficiency over their lifetime and consequently must be often replaced. It is also desirable that artificial lighting systems create a relatively low illumination level and that they be of a type to minimize UV (tungsten filaments or specially manufactured fluorescents with a low color temperature will do this).

Particulates and gaseous contaminants are minimized - if so desired - by a combination of high efficiency particle filters and carbon filtration. Since the cost of carbon filtration purchase and recycling is so high it is often omitted in areas of low SO_2 Carbon filters were not considered necessary here since SO_2 levels are well below Federal air standards (of 80 micrograms/M^3 or 0.03 ppm) and outdoor air intake for the museum is low (5cfm/person for 108 people).

The third criterion, relatively constant temperature and humidity, is obtained by running the building HVAC systems continually, with no "night setback" of temperatures as would be done in a residence or office building. Use of the "economizer cooling" cycle in winter (i.e. introduction of dry, cool outdoor air in lieu of mechanical cooling) is not appropriate for museum cooling because of the difficulty in maintaining humidity. Consequently, no economizer cycle is planned.

2.4.1 HVAC SYSTEMS

Future building usage indicated in the Historic Structures Report allotted a central mechanical room in the basement but no other mechanical spaces on any floor. Because of the limited headroom of approximately 8 feet under the floor joists, it would be impractical to attempt to run ductwork from a central air unit to the basement and first floor periphery. Consequently, the following four systems were considered for the building:

(A) Decentralized air handling units (AHU's) for each zone in the building, with integral packaged direct-expansion (DX) cooling and water-cooled condensing units.

(B) Decentralized AHU's for each zone, with a central water chiller supplying chilled water to air handling units.

(C) Four pipe fan coil units at periphery with air handling units for interior zones.

(D) Freestanding split-system air conditioning units with air-cooled condensers.

A brief description of each system alternative follows. Double-glazing of windows (recommended under energy-conservation measures, Section 2.3) has been assumed to enable the control of humidity in winter at a reasonable level without condensation. Because of the necessity for maintaining humidification and reducing air filtration costs, an economizer cooling cycle is not proposed. Either steam or electric humidification could be installed. In all system alternatives, the curatorial areas will be handled separately, as described under section 2.4.12.

On the basis of life-cycle costing, option A is the most cost effective. Results of the analysis are shown in Table 4.

2.4.1a Option A - Decentralized AHU's with DX cooling:

The first system considered is decentralized air handling units with matching direct-expansion cooling coils and integral water-cooled condensing units. Basement heating would be provided by existing historic pipe coils with proper controls added.

Air units for the first floor periphery would be located near the exterior wall in the basement (below the zone served). These units would supply conditioned air to floor registers; fresh air intake would be through louvers in basement windows. Heating would be provided by steam or hot water heating coils in each unit. The unit for the interior zone would be located over the restroom space beside the elevator; distribution supply ductwork for this unit would run at the ceiling of the first floor.

Air units for the second floor would be freestanding with steam or hot water coils for heating. Fresh air would be introduced from a unit located over the rest room space, with fresh air taken in through louvers in basement window openings via duct risers in the rest room core area. Humidity would be controlled by steam reheat coils and humidifiers.

2.4.1b Option B - Decentralized AHU's with chilled water cooling: This system is essentially the same as option A, from the standpoint of air handling and heating. In lieu of the direct expansion cooling coils and integral condensing units, a central water chiller with a double-bundled condenser for reheat (humidity control) would be used. Chilled water cooling coils would replace the DX coils.

2.4.1c Option C - Fan coil units: This option considers a four-pipe fan coil unit system, using hot and chilled water, at the periphery with air handling units for interior zones and humidity control. The interior units would be located over rest room spaces on the first and second floors. Outside air would be introduced through the air handling units via a fresh air duct riser integrated into the rest room arrangement. The water chiller would use double-bundled condensers (as in option B) for reheat and for heating in the fan coil units. The major advantage of this system is that space required for air handling units is minimized and that the necessary piping can be more readily integrated into the structure.

TABLE 4: ARSENAL HVAC SYSTEMS COST COMPARISON

Options

A. Decentralized single package units with DX or chilled water and cooling tower
B. Decentralized split package units with chiller and cooler tower
C. Four pipe fan coil units and cooling tower
D. Decentralized single package units with DX or chilled water and air-cooled condensers

OPTION	INITIAL COST	ANNUAL COSTS MAINTENANCE	ANNUAL COSTS FUEL(1)	30-YEAR OPERATING COST(2)	TOTAL 30-YEAR COST
A	$551,280	$3,000	$9,900	$253,290	$804,570
B	624,790	1,500	8,550	208,030	832,820
C	735,050	1,000	8,550	203,080	938,130
D	558,040	4,000	10,870	283,100	841,140

(1) Assuming oil-fired boilers.

(2) Discount factors of 9.891 (maintenance), 23.07 (oil) and 20.338 (electricity). Assuming 10% discount factor and 8% (oil)/7% (electric) differential escalation rates.

NOTE: Fuel costs shown for comparison in Tables 4 and 5 are not exclusive.

2.4.1d Option D - Freestanding split system air conditioning units with air-cooled condensers: In this scheme, freestanding split-system fan coil units would be located in each space discharging to an integral plenum with directional registers for supply air. Air-cooled condensing units would be located at grade outside the building; refrigerant piping would connect each air handling unit with a condensing unit. Two major disadvantages are: (1) air handling units would be exposed on the museum floor, posing a potential conflict with display cases; and (2) location of air-cooled condensing units outside the building may interfere with the historic image of the building and site. Consequently, this does not seem an appropriate solution.

2.4.1e Cooling tower location: The options for building air conditioning systems discussed in Sections 2.4.1a, b and c will all have similar condensing water flow requirements. The following alternatives were considered for supplying those requirements: (1) spray pond, (2) a cooling tower located in the attic, (3) an exterior cooling tower located above ground, and (4) an exterior cooling tower in a pit below grade.

The first three options were eliminated because of the following factors: (1) the incompatibility of spray trees with the historic appearance of the site, (2) inlet and exhaust air requirements (over 90sf roof louver openings) for the attic location for a cooling tower, and (3) concealment and aesthetic problems for an above-grade cooling tower. Installation of a cooling tower in a pit convenient to the building is therefore recommended. A grate would be required over the pit and a guard rail could be installed around the area.

2.4.1f Cost Estimates: Life cycle cost comparison for these four systems are shown in Table 4. The figures shown include the cost for complete systems for the basement and first and second floors, with provisions for future air conditioning of the third floor.

2.4.2 HEATING GENERATION SYSTEMS

Heating requirements for the Arsenal will be met using steam heat (with hot water converters where applicable). Alternatives for the production of steam discussed in this report are: (1) a central steam plant to serve the NPS buildings #1, 10, and 13 (discussed in section 6.2), (2) individual fossil fuel boilers for each NPS building (refer to sections on each building for discussion), (3) electric boilers for the Arsenal building and individual fossil fuel boilers for the other NPS buildings, (4) integration of a solar domestic hot water system with one of the above, and (5) integration of a solar heating system with one of the above.

The heating alternatives for the Arsenal are:

(A) Individual fossil fuel boilers

(B) Individual electric boilers

(C) Solar heating system combined with a boiler system.

(D) A solar domestic hot water system with backup from the fossil fuel or electric boiler system.

Life-cycle cost comparison for both individual and central systems (see Table 9 in Section 6) showed that, in the Arsenal, electric boilers are most economical.

2.4.2a Option A - Fossil Fuel Boilers for the Arsenal: In this scheme, the Arsenal would be heated by an individual boiler plant. Since reliability is relatively important in this building, installation of two steam boilers equipped for oil/gas firing was evaluated. Each boiler would supply two-thirds of the maximum heating load or about 1,000,000 Btu/hr. Domestic hot water and humidification requirements would also be supplied by the boilers.

The boilers would be installed in the mechanical equipment space allotted in the basement, as shown in Figure 8. Cast iron sectional boilers were chosen because of the limited access to the basement.

Fuel oil storage would be required; installation of two 3,000 gallon underground tanks as close to the boiler room as possible is recommended. Alternatively, gas could be supplied to the building. According to the Bay State Gas Company, which serves the Springfield area, gas service is available on State Street (at a 1/4 psig pressure) and could be brought to the building. Necessary piping would total approximately 500 feet.

The primary problem with using fossil fuel boilers in this building is that a vent is required for the products of combustion. Since this historic building never housed a boiler or fossil fuel-burning equipment and the Park Service wishes to maintain the

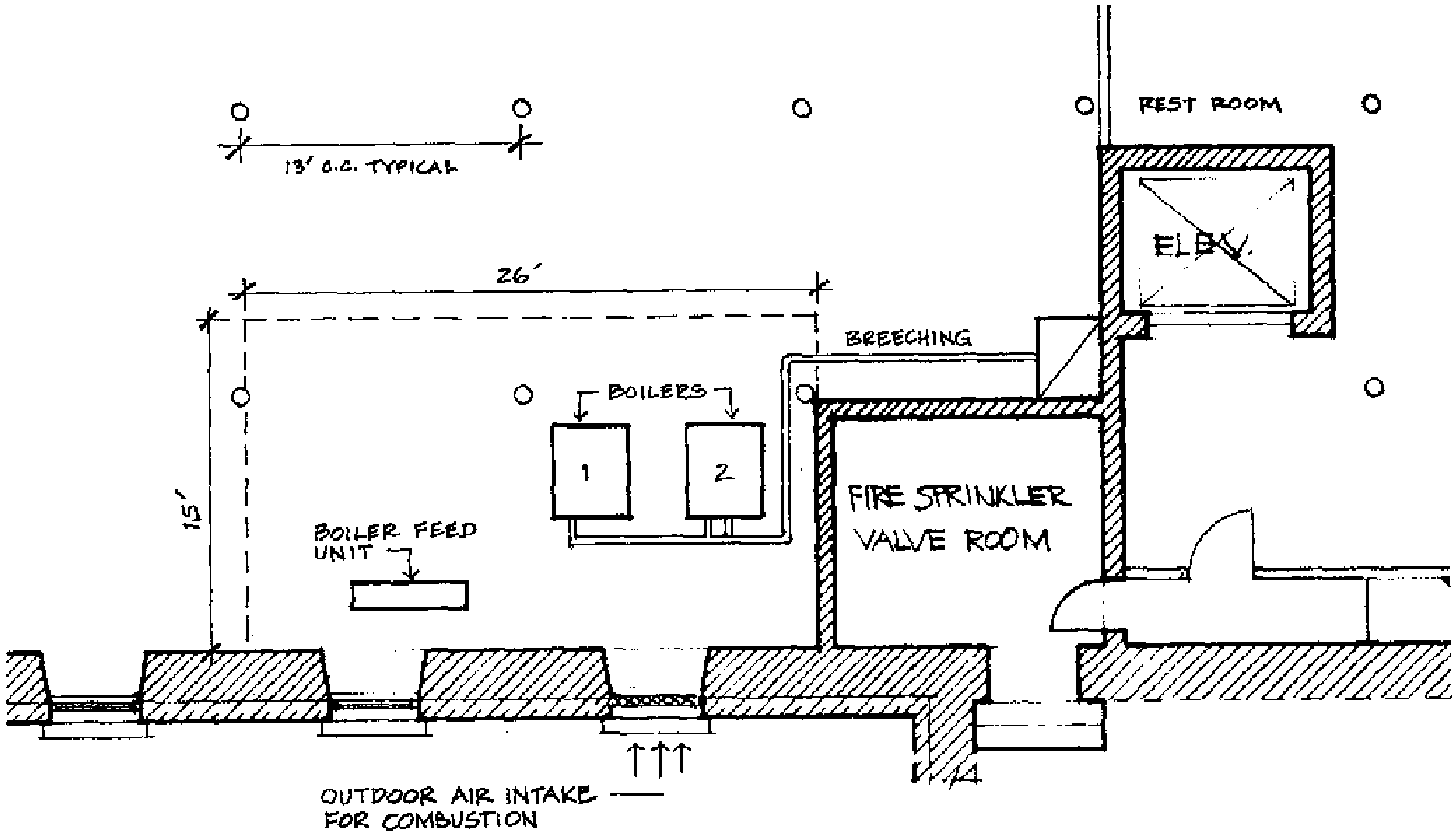


Figure 8: Boiler room layout, Arsenal basement.

exterior historic appearance, accomodation of a chimney or vent presents a design problem. Roof vents could be located as shown in the 1880 photo (Figure 9). Combustion air supply would be obtained through louvers installed in an existing basement window.

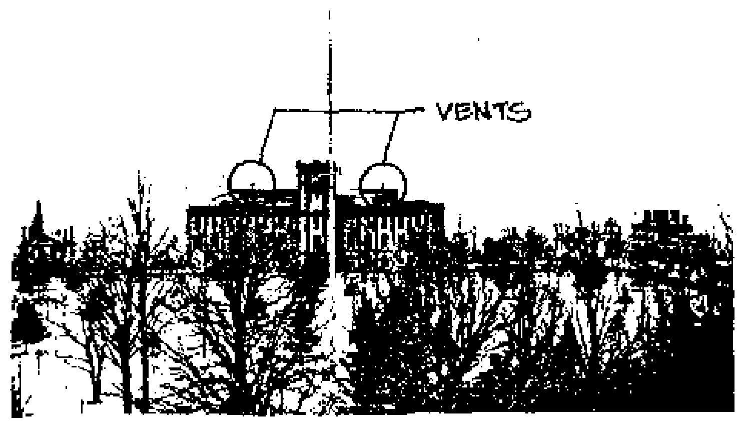


Figure 9: Main Arsenal, ca. 1880. Note location of roof vents. (Photo from the Historic Structure Report, historical data/base map, p. 69, courtesy of the Springfield City Library.)

2.4.2b <u>Option B - Electric Boilers for the Arsenal:</u> Installation of electric boilers would eliminate the problems involved in venting the boiler room if fossil fuel were to be used. Each boiler would be sized for two-thirds of the peak heating load for the building, or 300 KW. Small electric boilers would provide summer humidification and domestic hot water in order to minimize electric demand charges. Boilers would be located as in option A.

Installation of a 100KVA emergency generator might be desirable to prevent complete boiler shutdown if a power blackout occurred. Boiler operation at one-third normal capacity (100 kw) would permit a slower rate of temperature reduction in the museum, thereby protecting the collection from damage due to rapid temperature changes, and from condensation. A gas-powered 100 KVA electric generator is estimated to cost \$40,700; an oil generator is estimated to cost \$54,770.

2.4.2c Option C - Solar Heating System for the Arsenal: Solar-heated hot water ranging from 110° to 140° can be used for heating building spaces (and reheat) during most periods-- with the oil-fired or electric boiler providing higher temperature water for pickup loads. Underground storage would be provided in a 6,000 gallon tank. Location of the collectors is shown in Figure 10.

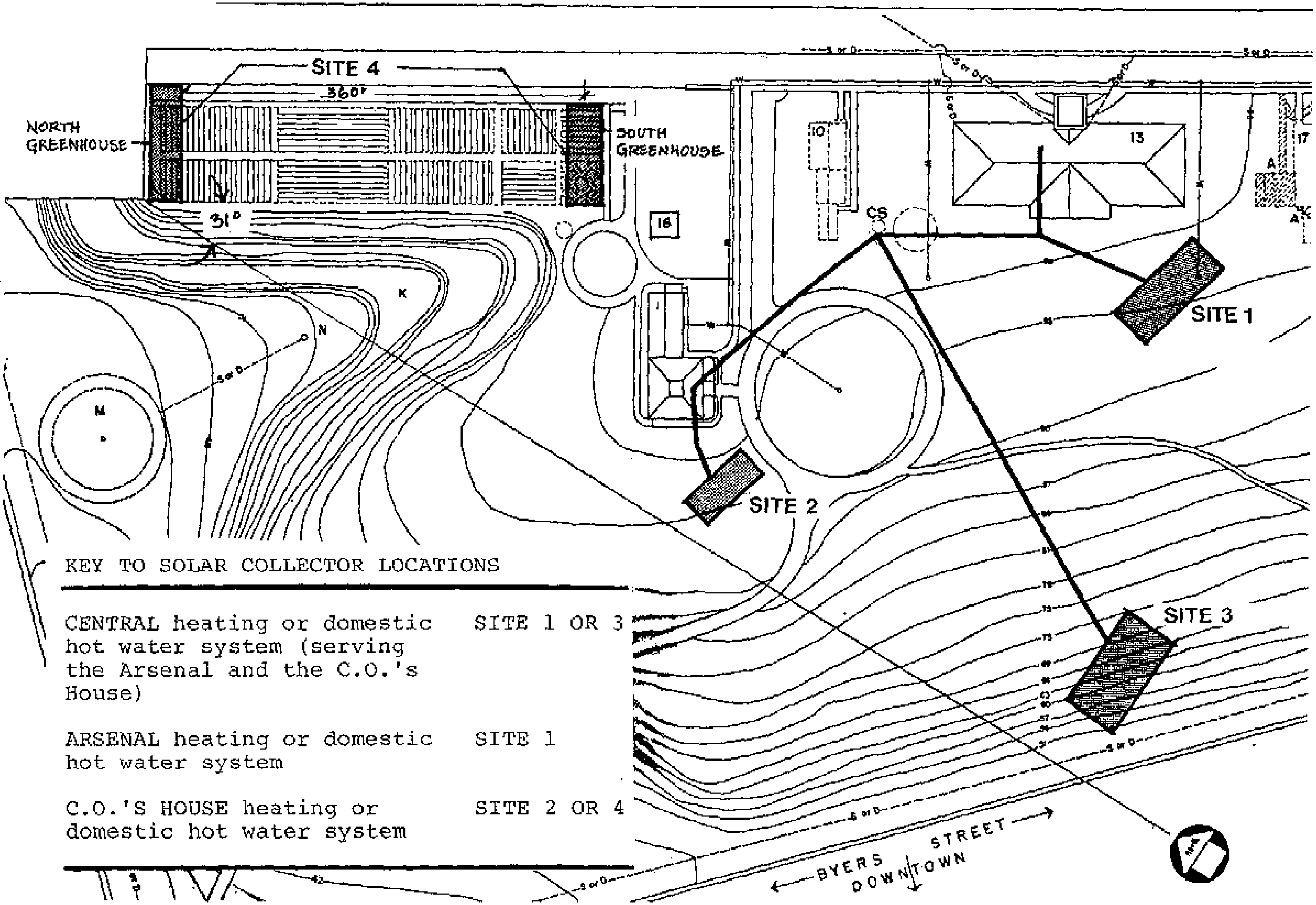
A 3,300 square foot collector system could provide 416.8 x 10^6 Btu's of heat to the Arsenal building annually. The solar system would cost approximately \$290,980 to install and save 3,755 gallons of oil or \$1,500 per year. The savings-to-investment ratio is therefore 0.2; payback would not occur within the economic lifetime of 30 years.

2.4.2d Option D - Solar Domestic Hot Water System for the Arsenal: Average domestic hot water consumption was estimated to be 100 gallons per day, requiring a thermal energy of 58,300 Btu's to provide hot water at 120°F. A conceptual sketch of the solar-assisted domestic hot water system is shown in Figure 11. A 130 gallon underground storage tank would be required. The location of the collectors is shown in Figure 10.

Collector area was sized to provide 100% of solar heating from June 1 to October 1, eliminating the need for boiler operation solely for domestic hot water during the summer months. This collector area is 87 square feet for the Arsenal building; it would yield 16.4 x 10^6 Btu's per year, reducing annual oil consumption by 170 gallons.

Costs for installing the solar system are estimated at \$8,880. The savings-to-investment ratio is 0.2 and the payback period is beyond the assumed economic lifetime of 30 years.

2.4.2e Cost Estimates: Life cycle cost comparison for the heating and cooling generation alternatives discussed above are shown in Table 5.



KEY TO SOLAR COLLECTOR LOCATIONS

CENTRAL heating or domestic hot water system (serving the Arsenal and the C.O.'s House)	SITE 1 OR 3
ARSENAL heating or domestic hot water system	SITE 1
C.O.'S HOUSE heating or domestic hot water system	SITE 2 OR 4

Figure 10: Location of solar collectors for heating and domestic hot water systems.

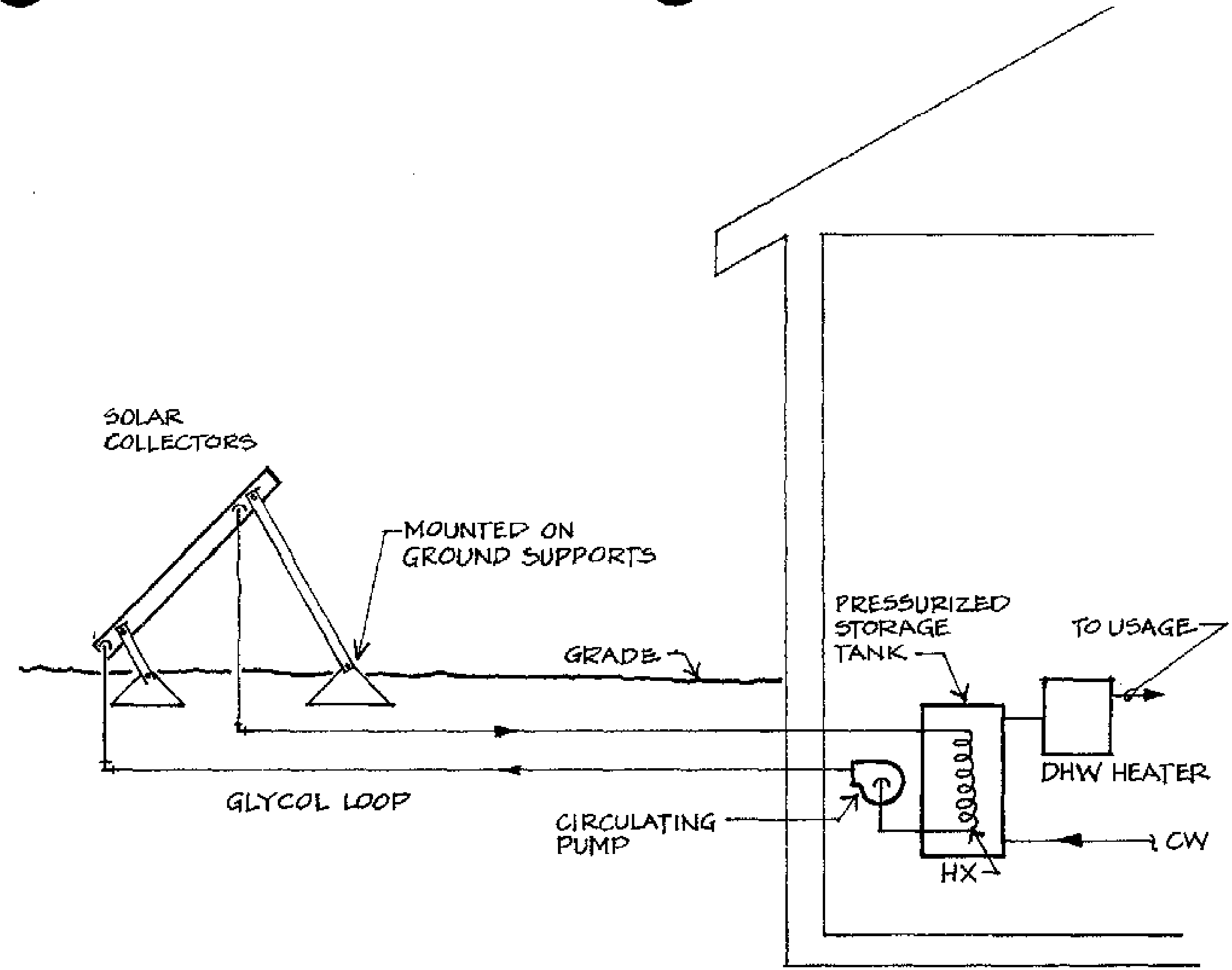


Figure 11: Solar domestic hot water system (schematic).

TABLE 5: ARSENAL HEAT GENERATION SYSTEMS COST COMPARISON

	ELECTRIC BOILER	GAS BOILER	OIL BOILER	SOLAR SYSTEM (2)
Initial Cost	$79,070	$94,230	$104,230	$290,980
Annual Costs:				
Maintenance	$ 200	$ 1,300	$ 1,300	$ 400
Fuel	$15,220	$11,270	$ 12,050	-
30-Year Operating Costs (1)	$312,780	$350,960	$290,850	$ 3,960
Total 30-Year Costs	$391,850	$445,190	$395,080	$294,940

(1) 8% oil, 10% gas, 7% elec. fuel differential escalation rates, and 10% discount factor. Factors of 23.07 (oil), 30.000 (gas), 20.388 (electric) and 9.891 (maintenance).

(2) Not an independent system; requires boiler installation for backup. Boiler cost will approximate costs shown for three fuel options.

2.4.3 PLUMBING

2.4.3a <u>Fixtures</u>: Renovation plans include the installation of rest rooms at the center area of each floor (Historic Structures Report, pp. 132-135). It is assumed that the existing toilet facilities will be removed. Basement toilet facilities will probably need to be located near the northeast side of the building in order to meet the elevation requirements for connection to the existing main sanitary outlet for the building. This outlet is located just above floor level at the northeast wall.

The number of fixtures required for the museum is based upon an anticipated peak load of 80 visitors (40 of each sex assumed), as indicated by the museum's personnel, and upon the Massachusetts Plumbing Code requirements. We have allowed for expansion of exhibit spaces to include the second floor spaces. On the floors not open to the public, the number of fixtures has been similarly determined for the anticipated maximum occupancy of 10 people of each sex. Thus the number of fixtures required is:

TABLE 6: REST ROOM FIXTURES REQUIRED

FLOOR	WATER CLOSETS (M/F)	URINALS (M only)	LAVATORIES (M/F)
Basement & 3rd	1/1	1	1/1
1st & 2nd	2/3	2	2/2
Total	6/8	6	6/6

Additional plumbing fixtures would be required for the curatorial area (e.g., service sinks), janitorial use, and electric water coolers. Plumbing facilities should conform with handicapped requirements.

2.4.3b Piping: No improvements are necessary. The existing 4" supply main is adequate for the proposed restroom and curatorial needs. New piping would be required to supply the restrooms and curatorial needs. Piping would run from the service entrance to the center of the building, up to each floor.

2.4.3c Hot Water: The existing 2000-watt electric 20 gallon hot water heater cannot supply the new hot water requirements for the building. However, since the source of domestic hot water is influenced by the choice of heating system for the building, domestic hot water heating is covered under section 2.4.2

2.4.3d Estimated Cost: The cost for plumbing work based upon the improvements and additions listed above (fixtures and piping) is estimated at $60,000. This estimate includes an allowance for provisions for future expansion on the third floor.

2.4.4 STORM AND SANITARY DRAINS

The existing 4" sanitary waste from the building is adequate to handle the new load for the proposed functional changes. There will be adequate space capacity for reasonable future expansion as well.

Exterior downspouts on the northeast wall (on either side of the clock tower) and at the northwest end of the building are clogged and one is broken at the base. Clearing of downspouts and sub-surface drains and repair of the downspout beside the clock tower should be undertaken to provide proper drainage for the building. Modifications are expected to cost $13,400.

2.4.5 FIRE PROTECTION

The present dry pipe sprinkler system provides adequate fire protection and could be retained for continued future use with only minor modifications. However, the Historic Structures Report stated that a gaseous system should be considered because of the possibility of water damage to the building and the gun collection. The following alternatives are considered here:

(A) Continued use of existing sprinklers in all areas except the curatorial lab, where a halon system would be installed. Cost: $51,470 or $0.80/sf average for building spaces.

(B) Installation of a halon system throughout the building. Cost: $947,620 or $14.51/sf average.

(C) Installation of a halon system on the lower three floors and a CO_2 system on the third floor and attic levels. Cost: $847,890 or $12.98/sf average.

(D) Installation of a halon system on all floors except the attic. Continued use of dry pipe sprinkler system in attic and clock tower.Cost: Cost: $810,090 or $12.50/sf average.

2.4.5a <u>Option A - Sprinklers plus halon in curatorial areas</u>: Continued use of the existing sprinkler system would be the least expensive alternative. The chance of water damage would be diminished by the gun preservation treatment (includes a hot wax application, presumably water repellent), the inclusion of some of the guns inside display cases and only local activation of sprinklers (limiting the number of exhibits actually contacted by the water).

The potential water damage to the historic fabric and guns will, however, weigh against the significantly lower cost for this alternative. Although certain other museums have decided against the use of water, notably the Colt Collection in the Connecticut State Library and the Smithsonian (where sprinklers are used only in public areas), gaseous extinguishing systems are not generally in use because of their cost. Self-closing sprinkler heads could be installed, which would automatically shut off when the fire had been extinguished, thereby reducing water damage to the museum.

Modifications to the existing sprinkler system to provide for continued use include the replacement of some branch lines and installation of self-closing sprinkler heads, a test of the entire system, and the installation of a halon system for the curatorial lab and associated areas where guns awaiting or undergoing preservation treatment would be stored. The estimated cost for these modifications is about $51,470 or roughly 80¢/square foot for the entire building.

2.4.5b Option B - Halon system throughout the building: A halon fire protection system offers certain advantages: there would be no water damage, people trapped within the building would not be in danger of suffocation from the halon gas (as is the case with a CO_2 system), and similarly firemen could more easily work inside the building. High recharging costs (for the gas tank) can be expected; at a cost of $8/lb., recharging a halon tank for one floor supply would cost roughly $32,000.

Of the available fire extinguishing systems, halon offers the least hazard to the building or people within it, at the highest cost. Installation costs were estimated at $947,620 for the building, or approximately $14.51/square foot overall.

2.4.5c Option C - Combination of halon and CO_2 system: Installation of a combination of gaseous systems was considered to reduce costs: halon for the basement and first two floors (public areas) and CO_2 for the third floor and attic. We believe that the reduction in first cost is not substantial enough to warrant the use of two different gaseous systems, for the following reasons:

(1) If expansion later required use of third floor spaces, the CO_2 system would have to be converted to a halon system. Only the fittings and some of the piping would be usable; most of the system would have to be replaced during this conversion.

(2) Firemen would have to be advised of the existence of the separate systems to prevent accidental suffocation of firefighters moving from a halon-protected area to a CO_2-protected area. Bulletins should be posted on several levels to notify building occupants and firefighters of the different systems.

The estimated cost for this combination of a halon system (basement, first and second floors) and a CO_2 system (third floor and attic) is $847,890, or approximately $12.98/square foot average for the building.

2.4.5d <u>Option D - Combination of halon and sprinkler systems:</u> A last combination of systems was considered: installation of halon systems on all floor levels except for the attic, and continued use of the sprinkler system in the attic. The possibility of water damage is greatly reduced since the halon system protects all occupied areas where fires are most likely to occur. The cost for this alternative was estimated at $810,090, or an average of about $12.40 per square foot for the building.

2.4.6 LIGHTNING PROTECTION

No improvements are necessary. The system is adequate and has been recently repaired.

2.4.7 SECURITY SYSTEMS

Additional security systems may be needed for the third floor spaces if the museum undergoes further expansion. Security is adequate for present renovation plans. Additional third floor intrusion detectors, at an extimated cost of almost $6,700, are not recommended at this time.

A complete, new security system for the museum and storage spaces, incorporating perimeter magnetic reed contacts on northwest and southeast windows, interior micro-wave detectors and display case detectors, and a tie-in to museum fire suppression systems could be installed for approximately $46,900. Nighttime monitoring of the system would be provided by ADT (or a similar security company) and daytime protection would be accomplished by a monitor at the guard's (reception) desk.

Additional security measures which could be incorporated include closed-circuit television (CCTV) monitored from the desk and a metal detection unit at museum exits. A two-camera first-floor CCTV security system is estimated to cost $15,400.

2.4.8 LIGHTING

Lighting fixtures should be fluorescent in all areas except for museum exhibit areas on the first floor and, in the future, on the second floor. The following systems are proposed:

Basement: Because of its low ceiling height, a fluorescent direct lighting source is recommended. Suggested methods are acrylic wrap-around luminaires mounted between joists or fluorescent luminaires with exposed lamps surrounded by large louvers to reduce lamp brightness.

First Floor: A flexible incandescent spot lighting system is recommended for exhibit areas. Fluorescent fixtures are recommended for the restrooms, reception and curatorial areas.

Second Floor: Existing incandescents are presently being replaced with suspended industrial-type fluorescent fixtures. Additional similar fluorescents could be installed as necessary.

Additional lighting modifications recommended are the installation of new stairway lighting, installation of emergency lighting throughout the building, and replacement of existing exterior flagpole lighting with two 250-watt quartz fixtures.

Lighting modifications and fixtures are estimated to cost $122,300.

2.4.9 ELECTRIC SERVICE

Electrical panels and wiring should be replaced, and a green equipment grounding conductor should be installed. (The original conduit is in good condition and could be used.) New tranformers and service equipment should be installed.

A new 15 KV primary electric service from State Street will be required to serve the entire park. An exterior transformer will be required since the basement ceiling clearance will not allow an indoor installation. The transformer will have a 480 grounded-Y/277 V,3 phase, 4 wire secondary and feed a new switchboard mounted within the basement. The switchboard will include breakers, metering and ground fault protection, and will provide power for the new HVAC equipment and a 208 grounded-Y/120 V,3 phase, 4 wire, step-down transformer. The switchboard shall be enclosed in a separate room.

A concrete underground vault could be built adjacent to the foundation to conceal the transformer. A removable grate would be required for installation and ventilation. The transformer would then feed a new switchboard mounted in an enclosed room in the basement.

Electrical service for the overhead lighting system would be run concealed in the joist spaces. Local display case lighting would be powered through floor receptacles. Existing ceiling outlets on the first floor should be abandoned, and the building should be completely rewired. New equipment and wiring costs are estimated at $135,100.

2.4.10 VERTICAL MOVEMENT

Elevator codes require the installation of a new elevator if passenger service is desired. For code compliance, the elevator shaft should be vented to the roof. The cost for a new electric passenger elevator cab within the existing shaft is estimated at $27,800. (This cost does not include shaft renovations which may be necessary for fire code compliance, nor does it include new electric motors.) Installation of an historically representative passenger elevator is estimated at $33,000. Shaft modifications and four new entrances are estimated at $50,000.

A 25 kw emergency generator for elevator operation in case of power outages is estimated to cost $9,100. The backup generator for the electric boilers, if installed, could be used for emergency elevator operation. Battery-powered emergency lighting could be eliminated and emergency lights could also be linked to the electric generator, saving about $1,500 allowed for battery emergency lighting. (This savings is reflected in the $9,100 estimate above.)

2.4.11 COMMUNICATIONS

Relocation of existing lines may be desirable, but only negligable costs ($600) are expected.

2.4.12 CURATORIAL TREATMENT SYSTEMS

There is an existing prototype curatorial area on the first floor of the museum which is about 50' x 12'. The curatorial treatment laboratory is expected to be approximately twice this size, or 50' x 24'.

The schematic plan in the Historic Structures Report shows the lab area located in the basement. However, the Park Superintendent has informed us that it may be located on the first floor of the museum so that visitors may observe the preservation treatment process through viewing panels.

According to the NFPA Life Safety Code (#101), the area must be separated from the museum space with a 1-hour fire resistance rating; openings to the museum area must be protected by self-closing or automatic closing fire rated assemblies.

Provision for the curatorial procedures and equipment involved will include: venting of the dip tank, plumbing to sinks for hot soapy water treatment, venting from the solvent dip tank, makeup air supply, and electrical service to the drying ovens (240 V, 3 phase, 60 HZ). The curatorial area will be completely enclosed, separate from other areas of the building, with separate air supply and exhaust, maintained constant at 72°, 50% RH in summer and 72°, 30% RH in winter. A photography laboratory for developing and printing will also be located in this area.

Exhaust duct risers can run in the rest room core areas to a fan in the attic exhausting to the outside.

Make-up air should come from the museum area in order to maintain the curatorial treatment area at a negative pressure.

Water from fire sprinklers is not desirable in this area; a Halon system which uses a relatively non-toxic gas is recommended. For a discussion on the fire protection in this area, see section 2.4.6.

The industrial drying ovens will require a separate transformer to power them since they are rated at 240 V, 3 phase. A separate 100A, 240 V, 3 phase, 3 wire panel should be provided in the treatment lab for the ovens. All equipment wiring should have a green equipment grounding conductor.

An allowance for mechanical and electrical system improvements is estimated at $17,800.

Acid waste containers will be located under the sinks or in the basement. The waste will be collected by a private contractor for disposal.

3. COMMANDING OFFICER'S HOUSE

3.3 BUILDING SKIN IMPROVEMENTS

3.3.1 WINDOW AND WALL IMPROVEMENTS

The present structure has a combined wall transmittance of 0.27 Btu/hr-°F-sf, which is within the limits specified in the ASHRAE Standard 90-75, "Energy Conservation in New Building Design." If existing storm windows are removed as a part of the effort to restore the historic structures, it is assumed that an equivalent form of double-glazing would be installed in order to conform with the standard. In addition, we noted missing storm panes on a couple of the windows on the first floor; these should be installed to maintain energy conservation standards and protect the historic window frames and panes.

3.3.2 ROOF IMPROVEMENTS

Conformance with the ASHRAE Standard 90-75 for roof transmittance of 0.075 Btu/hr-°F-sf will require installation of insulation with an R-value of at least 8.8. 2-1/2" fiberglass batt insulation (R=9.25) on the attic floor is recommended. Louvres, to ventilate the attic spaces, and doors at the attic entryways in the main section of the house, to isolate the attic, will also be required. By these means, heating requirements will be reduced by approximately 230 x 10^6 Btu/yr, saving $1,050 in heating costs annually.

Installation costs are estimated at $6,100. For a thirty year economic lifetime, 10% discount rate and an 8% fuel escalation differential rate, the discounted payback period is 6.1 years.

3.4 BUILDING SYSTEM IMPROVEMENTS

The Commanding Officer's House will be upgraded to permit use of spaces for community activities on the first and second floors; much of the basement will be opened to the public for viewing of the historic heating systems. According to the program in the Historic Structure Report, the first floor will be converted to lecture and meeting room space (in the main section of the house) as well as park service offices (in the wing). The second floor of the wing will retain its original design for accomodations of park personnel or official visitors. The basement wing is allocated to mechanical and maintenance space.

Peak occupancy levels for the CO's House were estimated by the Park Service at 40 people in the community areas, 12 people in basement exhibit areas, and 6 staff members in mechanical, office and apartment spaces.

3.4.1 HVAC SYSTEMS

Several options were considered for heating and cooling systems for the Commanding Officer's House. These included: (1) adaptation of the existing gravity hot air system for future heating, (2) installation of electric radiation heating (this option was eliminated for reasons of energy, cost, and historic integrity), (3) adaptation of the existing heating system for cooling with DX coils in "heating chambers", (4) window air conditioning units, and (5) fan coil units.

3.4.1a <u>Heating</u>: The existing gravity hot air system would be reasonably adequate if properly controlled. The following modifications are recommended: Individual self-powered control valves should be installed on the existing steam radiators to prevent overheating. The existing steam heating coils can be connected to the proposed boilers (see sections 3.4.2 and 6.2) with condensate return lines added.

Volume dampers should be added to the existing ducts being used to supply hot air to registers, to permit balancing. The present system operates on 100% outdoor air; return air ducting from the first floor should be added for each system. Return air grilles should be located in the floor as close to the air intake for the chambers as possible.

New night/day thermostats and steam control valves are required for each heating chamber to replace existing rusted and inoperative controls.

3.4.1b Air Conditioning Option A - Existing Ducted System: Modification of the existing heating system to permit air conditioning would include the addition of fans, filters and direct expansion cooling coils in the brick heating chambers. Air-cooled condensing units would be required; these three units (one/heating chamber) would be located outside the building. Some adjustment of the existing supply registers would be required in order to maintain sufficient velocity to properly distribute the cold air to the spaces. Modifications discussed under section 3.4.1a are assumed to be implemented.

3.4.1c Air Conditioning Option B - Window Units: Continued use of existing window air conditioners and installation of similar units as necessary is another alternative.

3.4.1d Air Conditioning Option C - Portable Units: This option considers the possibility of window air conditioning units to serve the meeting rooms on the first and second floors in the main section, which would only be installed when the rooms were being used. The wing, comprised of park offices on the first floor and park living quarters on the second, would either not have air conditioning or use an air handling unit with direct expansion cooling coils. Wing air conditioning would utilize the existing wing heating chamber and ductwork, which would have the least impact on the historic fabric of the building.

The 1-1/2 to 2 tons capacity portable window units would be relatively heavy and require dollies for transporting them from storage to use. The units could be stored in the Park Service area on the first floor and in existing closets on the second floor. No more than 2 units on each floor should be required, assuming that only two rooms on each floor would be used simultaneously in the summer cooling season.

We therefore estimate a requirement of 4 portable window type air conditioning units and an air handling unit and associated cooling coils for use with the existing heating system in the wing.

TABLE 7: COMMANDING OFFICER'S HOUSE HVAC SYSTEM COMPARISON

	OPTION	COST	ALL SPACES COOLED SIMULTAN-EOUSLY	INDIVIDUAL ROOM CONTROL	RELATIVE MAINTENANCE COST	EXPECTED EQUIPMENT LIFE	COMMENTS
A.	Air handling unit with cooling coil attached to existing heating systems. Air cooled condensing units.	$16,880	Yes	No	Medium	15 years	Most appropriate to historic building.
B.	Window air conditioning units.	10,130	Yes	Yes	High	10 years	Least appropriate to historic building.
C.	Mobile roll-away air conditioning units in main buildingl Wing offices handled as in option A.	13,130	No	Not in wing office area	High	10 years	Appropriate to historic building. Mobile units inconvenient to use.
D.	Fan coil units with air cooled water chiller.	56,270	Yes	Yes	Low	20 years	Best system for temperature control. Pipe routing may be a problem.

NOTE: Modifications to existing gravity hot air system for better heating (3.4.1a) are expected to cost $13,300

3.4.1e <u>Air Conditioning Option D - Fan Coil Units</u>: Cooling could be provided by fan coil units installed under or near the windows, served by a two-pipe chilled water system. An air-cooled chiller located at grade would supply the chilled water. Ventiliation of meeting rooms would be supplied through the existing ductwork system; fans would be required to provide the air supply.

3.4.1f <u>Cost Estimates</u>: Table 7 outlines the base costs anticipated for the systems discussed above. Window unit air conditioners are not recommended because of the visual intrusion of these units on the historic appearance of the house. Fan coil units are not cost effective when compared with the cost of modifications to an existing air distribution system. Consequently, we recommend the adaptation of the existing system for both heating and cooling.

3.4.2 HEATING GENERATION SYSTEMS

Heating requirements for the CO's House will be met using steam heat. Electric boilers were eliminated from consideration since they could become cost effective only if the cost of new flues is considered. New flues are not required. Steam was selected rather than hot water for the potential of using existing internal steam piping and heating coils.

The alternatives for steam generation include: (1) a central steam plant to serve the NPS buildings (discussed in section 6.2), (2) individual fossil fuel boilers for each NPS building (refer to sections on each building for discussion), (3) electric boilers for the Arsenal building and individual fossil fuel boilers for the other NPS buildings, (4) integration of a solar heating system with one of the above, and (5) integration of a solar domestic hot water system with one of the above.

The heat generating system alternatives for the CO's House discussed here are (1) individual fossil fuel boilers, (2) a solar heating system combined with the boiler system and (3) a solar domestic hot water heating system combined with one of the above.

Life cycle cost comparison of both individual and central systems showed that individual gas-fired boilers for the C.O.'s House (only) are the most economical system; refer to Table 9 in Section 6.

3.4.2a <u>Fossil Fuel Boiler:</u> A cast iron sectional boiler of about 700,000 Btu/hr capacity would be required. The gas/oil fired boiler would be installed in basement room B11 and it would be necessary to field-erect the boiler because of the limited access from outside. Related equipment such as a boiler feed unit would be installed in room B11 also. A schematic showing the proposed equipment locations is presented in Figure 17.

The existing chimney venting the fireplaces on the first and second floor of the wing appears large enough to vent combustion gases for the boiler, although some structural modifications would be required to connect the boiler flue to the chimney vents. Brickwork at the basement ash pits would be removed and connection to the two existing chimney openings would be required.

Combustion air supply would be provided through louvers in an existing basement window opening and a small sash could be installed. The available window leads to the underside of the front porch so no alterations will be visible from the outside. If oil-firing burners are used, an underground oil storage tank would be located between the garage and the C.O.'s House. A 2,000 gallon tank is recommended.

Gas could be used as an alternative to fuel oil. (Refer to sections 6.2 for further discussion on the use of gas in lieu of fuel oil.) Gas would be brought to the site with a 6" pipe running to the Arsenal and a 2" pipe to the C.O.'s House from the Arsenal. (The Master Armorer's House could be connected if it is relocated.)

3.4.2b <u>Solar Heating System:</u> The heating system would have to be modified from steam to hot water heating to permit use of a solar heating system. Hot water at 110° to 140°F would be provided by the solar system with higher temperature water from the boiler for pickup loads. A 1,370 square foot collector system was evaluated for the Commanding Officer's House. A 2,500 gallon underground storage tank would be required. Overall, the system would provide 170 x 10^6 Btu's per year, saving the equivalent of 1,510 gallons of oil. The collector locations are shown in Figure 10.

<u>Solar Collectors as Historic Greenhouses:</u> Installation of solar collectors as a historic reconstruction of

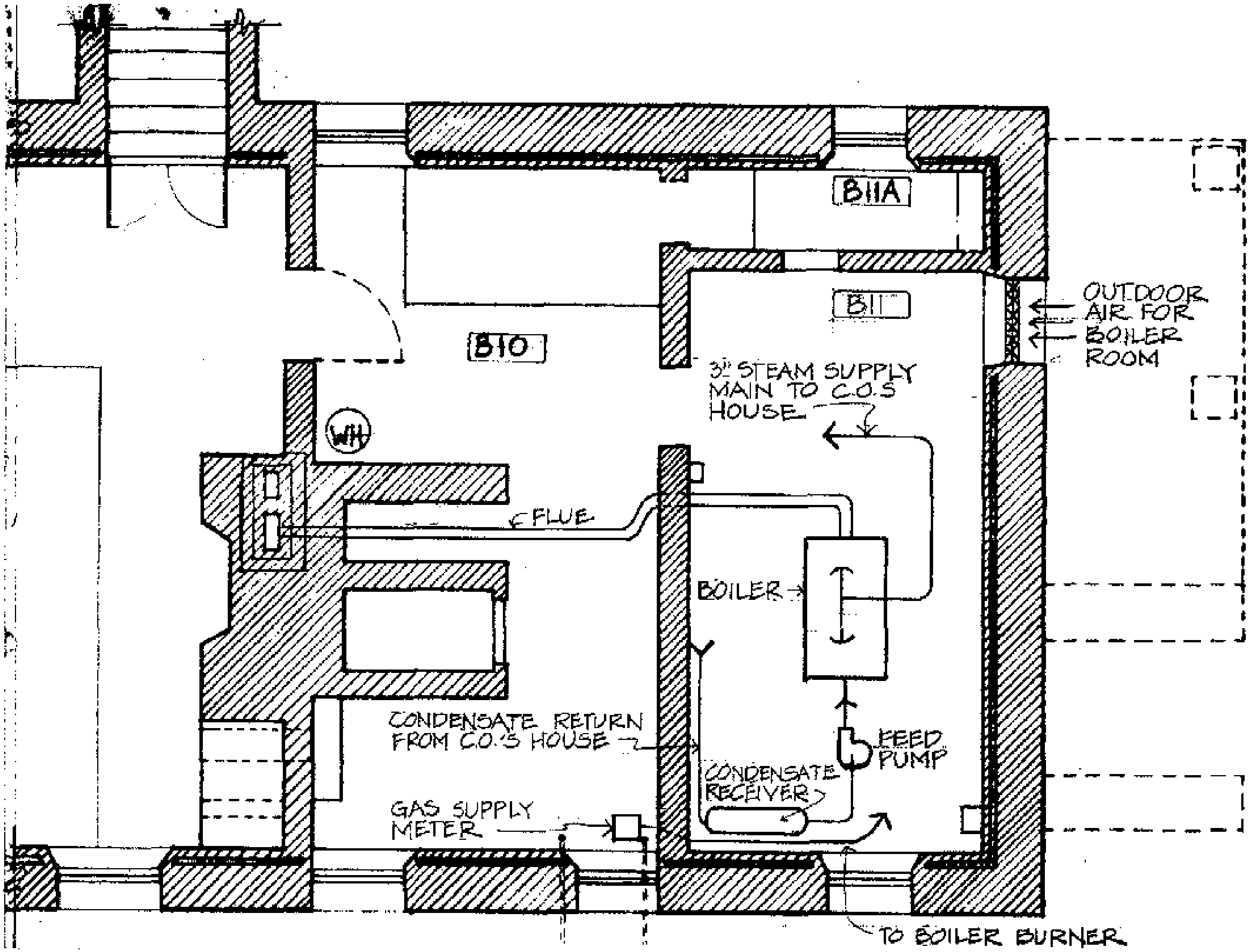


Figure 17: Boiler room layout (C.O.'s House basement) for Commanding Officer's House heating plant.

the greenhouses once located to the northwest of the C.O.'s House was considered. The greenhouse site faces 31° east of true south and the original structures had glass areas of 850 sf and 960 sf at a 30° to 35° glass angle. Effectively, this total glass area of 1800 sf would provide heating to only the C.O.'s House.

A system sized to replace the 1800 sf of glass surface on the old greenhouses at a tilt of 35° would provide 160×10^6 Btu's of useable space heating for the Commanding Officer's House each year. The system would cost $112,980 and save 1680 gallons of fuel oil per year. This cost reflects a decrease in collector structural costs, which are assumed to be included in greenhouse reconstruction costs and are not included here.

The optimum angle for heat collection at this latitude is 51° from horizontal facing true south. With the collectors tilted at 51°, an array two collectors high totalling 1900 sf would provide roughly 200×10^6 Btu's per year for a savings of 2070 gallons of fuel yearly. The system would cost $127,280.

If a 51° tilt is considered too steep, or, since the base would not match the same base area as the historic greenhouses, a compromise slope of 45° tilt has been considered. This 2100 sf collector area at a 45° tilt would provide 235×10^6 Btu's per year for a savings of 2400 gallons of fuel oil per year. Installation cost is estimated at $127,280. Collector locations are shown in Fig. 10 (p.43).

3.4.2c <u>Solar Domestic Hot Water System</u>: Approximately 60 gallons per day was estimated to be the domestic hot water consumption at the Commanding Officer's House. Daily thermal requirements are therefore 35,000 Btu (to provide hot water at 120°F). A conceptual sketch of the solar-assisted domestic hot water system was shown in section 2.4.3, Figure 11. The proposed collector location is shown in Fig. 10.

A collector area of 52 square feet was sized for this thermal load, yielding 9.8×10^6 Btu/yr or the equivalent of 100 gallons of oil. An 80 gallon underground storage tank would be required. Installation costs were estimated at $5,720. At an oil cost of 40¢/gal., the present value of savings is $920 and the savings-to-investment ratio is 0.3. The annual savings are

$40 and the payback period is beyond the assumed economic life of 30 years.

3.4.2d Cost Estimates: Life cycle cost estimates and economic parameters for the various options discussed above are shown in Table 8.

TABLE 8: CO'S HOUSE HEAT GENERATION SYSTEMS COST COMPARISON

Options

1. Gas-fired boiler
2. Oil-fired boiler
3. Solar system (requires boiler for backup)

OPTION	INITIAL COST	ANNUAL COSTS MAINTENANCE	ANNUAL COSTS FUEL	30-YR OPERATING COSTS (1)	TOTAL 30-YEAR COST
1	$28,160	$700	$2,950	$ 95,400	$123,560
2	32,160	700	4,370	107,700	139,860
3	123,610	170	-	1,700	125,310 (2)

(1) 8% oil, 10% gas fuel differential escalation rates and 10% discount factor. Factors are 23.07 (oil), 30.0 (gas) and 9.891 (maintenance).

(2) Solar system requires boiler installation for backup. Boiler cost will approximate costs shown for three fuel options.

3.4.3 PLUMBING

The present 1-1/2" water supply will be adequate for the proposed use of the building. The brass and copper piping is in good condition and can continue to be used.

In general, the existing fixtures and piping appear to be in good, operable condition. Water leakage in lavatory room 208 should be repaired. Leaks noted in soil lines in rooms B08 and B02 should be repaired or replaced. No other leaks were noted and general maintenance is all that is required. Although the lead drains and traps are functional and do not have to be replaced, the longevity of the system is questionable and replacement might be advisable. Installation of fixtures for the handicapped will probably be required.

Repair costs are estimated at $1,100; replacement of drains and traps is estimated to cost $5,600. The estimate does not include alterations or additions to existing plumbing facilities to meet handicapped requirements. Existing first floor toilet rooms are too small to accomodate required modifications; existing second floor toilet rooms could be modified.

3.4.4 STORM AND SANITARY DRAINS

Downspouts and sub-surface drains should be cleaned out. Regular maintenance of exterior drains is required to prevent clogging. Recommended work is estimated to cost $1,100.

3.4.5 FIRE PROTECTION

Recommended improvements include: installation of smoke detectors throughout the remainder of the CO's House, installation of heat detectors in the attic and boiler room, and installation of an exterior fire alarm light. A halon fire extinguishing system is recommended for document and records protection, although most of the records could be kept at the Arsenal if a halon system is installed there.

The estimated cost of all recommended improvements (excluding the halon system) is about $6,700.

3.4.6 SECURITY SYSTEMS

Installation of ultra-sonic intrusion alarms is recommended for all areas with doors and windows that could afford entry, except first floor offices which are already protected. A complete security system for the building is estimated to cost $5,000.

3.4.7 LIGHTNING PROTECTION

No improvements are required; the system was recently upgraded and is completely functional and adequate.

3.4.8 LIGHTING

Restoration of wall-mounted pull-chain switch incandescents is recommended. Existing incandescent fixtures could be retained; overhead wrap-around fluorescents in use in office areas should be replaced with historically appropriate fixtures. Unless extensive new wiring is installed in place of the existing (see section 3.4.9), original fixtures should not be kept in use. We recommend that floor lamp fixtures be provided and utilized for lighting to minimize the impact of fixture midifications on the historic structure.

An allowance of $8,300 was estimated for interior lighting modifications.

3.4.9 ELECTRICAL SERVICE

All house circuitry except for existing wiring to air conditioning units and the grounded load center and related receptacle circuits should be replaced in order to meet the current National Electric Code. (There is no specific requirement to replace circuitry, unless building alterations involving electrical work are undertaken.) The metal surface raceway for the overhead porch light should be replaced with rigid steel conduit.

The cost for these modifications will depend upon the extent of electrical service required. The cost for installation of electrical service to the basement, first and second floors (baseboard receptacles) is estimated at $21,400.

3.4.10 VERTICAL MOVEMENT

Requirements for elevators in the CO's House to provide access for handicapped persons is under investigation by the Park Service.

3.4.11 COMMUNICATIONS

The lines are adequate for present use. Wiring and outlets may detract from the historical appearance of the rooms when the offices are moved, and alternate or additional lines may be desirable when the building is opened to the public. The existing doorbell could be replaced with an old-style system more appropriate to the design of the building. An allowance of $700 has been made for the relocation of existing telephone lines and the replacement of the doorbell.

4. GARAGE

4.1 GENERAL BUILDING DESCRIPTION

This brick building was built in 1937. It is 21-1/2 feet square and has a mineral-surfaced fabric roof. The building provides storage space for maintenance vehicles and equipment.

4.2 EXISTING SYSTEMS

4.2.1 HEATING SYSTEM

There is an existing steam radiator in this building which is connected to underground steam and return lines to the CO's House. This system is presently inoperative due to a break in the underground steam pipe from the Commanding Officer's House. Installation of a new steam pipe would make the existing heating system operational.

4.2.2 OTHER SYSTEMS

Ventilation is provided only by infiltration through the three windows and the doors. Existing lighting is fluorescent. No water supply, fire or lightning protection, security or communications system was ever installed in the garage.

4.3 BUILDING SKIN IMPROVEMENTS

4.3.1 WINDOW AND WALL IMPROVEMENTS

The transmittance of the garage walls, windows and doors was evaluated for compliance with the ASHRAE Standard 90-75, requirements of 0.27 Btu/hr-°F-sf. The existing 8" brick walls, plywood-covered windows and wood doors have an overall transmittance of 0.765. Installation of 1-1/2" urethane foam insulation is required in order to lower the U-value to 0.246. Installation of a sheet rock finish is also recommended. Insulation and sheet rock costs are estimated at $1,100.

Double-glazed windows should be installed. Garage doors should be gasketed and weatherstripped to reduce infiltration; insulating doors is not warranted. A storm door should be added to the personnel access door.

4.3.2 ROOF IMPROVEMENTS

The existing masonite ceiling and built-up roofing have a combined transmittance of 0.329. Compliance with the ASHRAE 90-75 recommended transmittance of 0.074 Btu/hr°F-sf would require the installation of insulation with an R-value of 10.6. Installation of 3-1/2" fiberglass batt insulation under the roof joists would lower the transmittance to 0.071 Btu/hr-°F-sf. This would require the removal of the existing ceiling; replacement by a sheet rock ceiling is recommended to increase fire resistivity. Installation of insulation and sheet rock is estimated at $500.

4.4 BUILDING SYSTEM IMPROVEMENTS

Repair of existing steam lines from the CO's House will permit use of the existing heating system. Fluorescent lighting in the garage should be increased only as necessary. No other mechanical or electrical improvements are necessary.

5. GATEHOUSE

5.3 BUILDING SKIN IMPROVEMENTS

5.3.1 WINDOW AND WALL IMPROVEMENTS

Existing windows were single glazed but were severely damaged by the fire and subsequently removed. Replacement windows and door should be double-glazed.

The additional cost for installation of double-glazing instead of single glazing is estimated at $400.

The transmittance of the existing wall structure (walls, windows and door) is 0.600 Btu/hr-°F-sf and will be improved to 0.504 Btu/hr-°F-sf by double-glazing. Although that does not bring the transmittance up to the ASHRAE 90-75 standard of 0.27, installation of wall insulation was considered to be inappropriate for the historic wall structure.

5.3.2 ROOF IMPROVEMENTS

As a result of fire damage to the roof structure, it will be necessary to remove the existing ceiling and replace roof beams and joists. Consequently, installation of insulation between roof joists will be facilitated. Insulation with a resistance (R-value) of 10 should be installed so that the building complies with the ASHRAE 90-75 recommended transmittance of 0.074 Btu/hr-°F-sf. The present transmittance or U-value is 0.338 Btu/hr-°F-sf. Installation of 2-1/2" fiberglass batt insulation (R=11) would cost about $110. The new roof transmittance would be 0.073 Btu/hr-°F-sf.

5.4 BUILDING SYSTEM IMPROVEMENTS

5.4.1 HEATING AND COOLING SYSTEMS

This well-shaded and heavily-built structure will probably not require mechanical cooling; operable windows will provide sufficient natural ventilation. If mechanical cooling is required, installation of a window air conditioning unit in a rear window is recommended.

Heating could be supplied by either gas or electric heaters. Installation of electric heaters is recommended since electric service to the building will be installed for lighting. Electric heater costs are included in the estimate for electric service.

5.4.2 LIGHTING AND COMMUNICATIONS

Electrical service could be brought from the State Street utility lines or provided from the site lighting service if this service is adequate. Telephone lines should also be installed. An allowance of $4,400 is estimated for these modifications.

6. SITE UTILITIES

6.1 GENERAL DESCRIPTION

Operation of the Springfield Armory National Historic Site was transferred to the National Park Service in March 1978. The NPS buildings are the Arsenal museum (Bldg. 13), the Commanding Officer's House (Bldg. 1), the Master Armorer's House (Bldg. 10), the Gatehouse (Bldg. 33) and the Garage (Bldg. 18). Building 10 is presently located on the grounds of Springfield Technical Community College, which occupies the remainder of the original Armory site. This building may be moved onto the NPS grounds to a location between Buildings 1 and 13. Building 10 was excluded from the study but its relocation may impact the study of a central heating plant now being considered for the NPS buildings (see section 6.2).

Utilities are generally supplied from the Springfield Technical Community College but the Park Service intends to divorce its utilities from the college system as a part of its modernization program. In the foreseeable future, the NPS buildings will no longer use the college steam supply.

The utilities include natural gas service to the CO's House and 10 psig steam lines, 600 volt electrical service, 6" water and fire service loop, and combined storm and sanitary sewer lines to both the CO's House and the Arsenal, and a disconnected fire alarm and police signalling system to the Arsenal. All these utilities are provided from the college, underground. The Springfield Armory connections are detailed below:

(1) 2-1/2" natural gas service to the C.O.'s House, now capped inside the building.

(2) 2-1/2" brass water service to the C.O.'s House, 4" cast iron domestic water service to the Arsenal, and 8" cast iron water service to the Arsenal sprinkler system.

(3) Capped lead pipe branches from the water service which had been connected to a pond fountain and the Master Armorer's House when at its old location, both between Buildings 1 and 13.

(4) Six 10" underground brick rainwater pipes from the Arsenal roof leaders and one 4" sanitary line from the Arsenal, to the 20" brick sewer which terminates in a 24" municipal sewer on State Street.

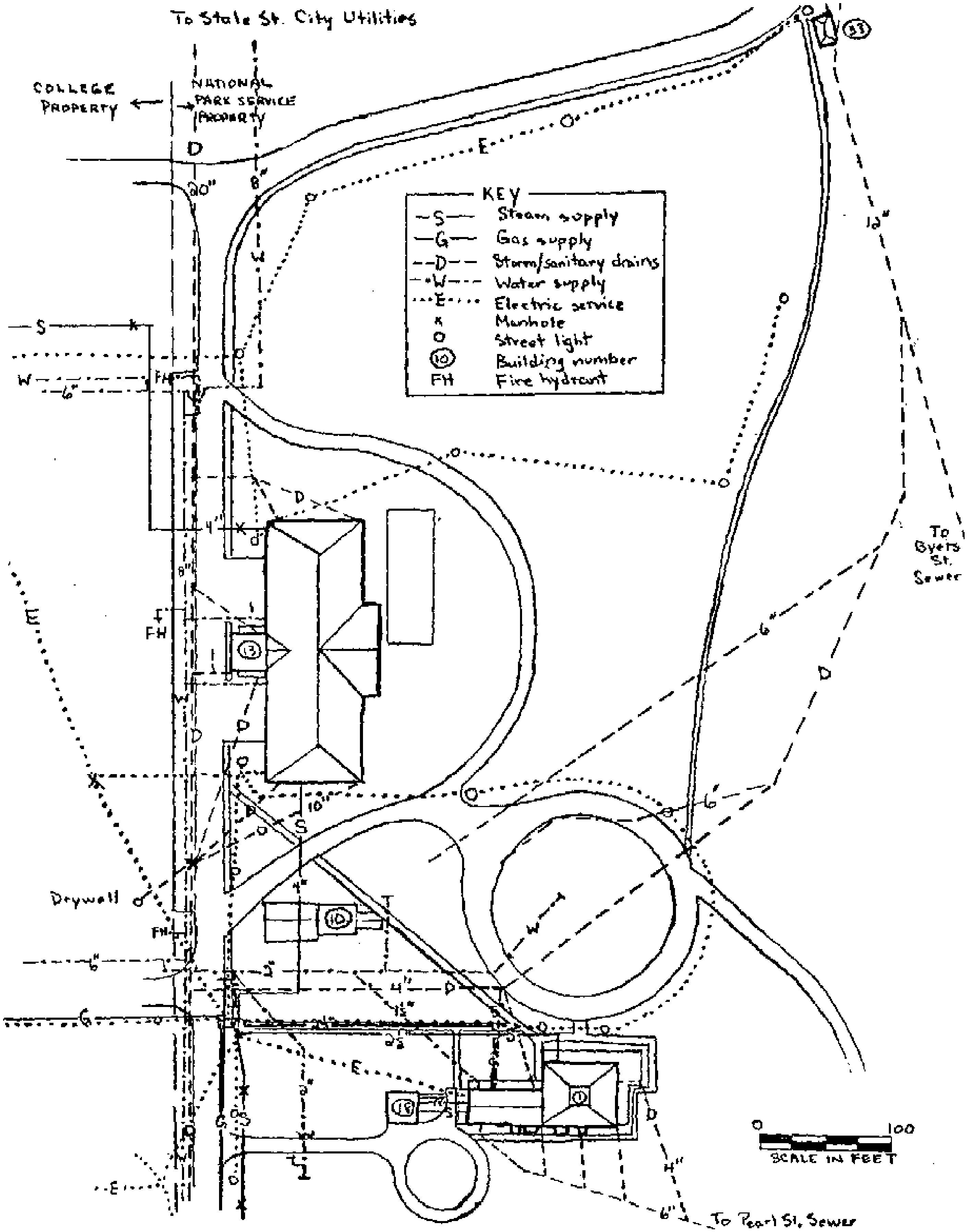


Figure 19: Site plan and building utilities.

(5) Four 4" sewer pipes from the CO's House, connecting to a 6" brick sewer which terminates in the municipal sewer on Pearl Street, and one 5" sewer line from the southwest side of the CO's House, connecting to a line[1] which terminates in the municipal sewer on Byers Street.

(6) 4" steam main to the Arsenal and a 2-1/2" line from this main in the Arsenal to the CO's House.

(7) 575 V/120 V transformers and electric meters at the electric service entrances to the CO's House and the Arsenal.

The Arsenal security and fire alarm system is also underground, to an ADT central monitoring station.

6.2 CENTRALIZED HEATING PLANT

The existing underground steam lines, supplied from the College, were installed in 1906 and are over 70 years old. There is no condensate return; condensate is exhausted into the sewer lines at each building after passing through its heating system. Due to the age and questionable condition of these lines, future use of the existing underground system was eliminated from any discussion of a new centralized site heating plant.

As the Armory is planning to sever its relationship with the College so that all utilities will be independent, the following alternatives were considered:

(1) A central boiler plant located in the CO's house to serve that building, the Main Arsenal, and the Master Armorer's House, if it is relocated, via new underground steam supply and condensate return mains.

(2) Individual fossil fuel boilers in the CO's House and the Main Arsenal. (Building 10 was excluded from the study but would presumably also have an individual boiler.)

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[1] Size not shown on General Storm and Sanitary Sewer Map of 1962.

(3) Individual boilers in the CO's House and the Main Arsenal; gas/oil-fired for the former and electric for the latter.

(4) A central solar plant to provide hot water heating to the CO's House and the Main Arsenal and to Master Armorer's House when relocated.

Individual boiler options (#2 and #3) were considered under sections 2.4.2 and 3.4.2 and are summarized in the table below. The central heating plant options (#1 and #4) are discussed in the following sections.

TABLE 9: *SUMMARY OF SITE HEATING OPTIONS*

Options

1. Gas-fired Central Plant
2. Oil-fired Central Plant
3. Individual gas-fired boilers
4. Individual oil-fired boilers
5. Gas-fired boiler in CO's House and Electric in Arsenal
6. Oil-fired boiler in CO's House and Electric in Arsenal

OPTION	INITIAL COST	ANNUAL COSTS MAINTENANCE	ANNUAL COSTS FUEL	30 YEAR OPERATING COSTS [1]	TOTAL 30-YR COST
1.	$157,480	$1,500	$15,700	$485,840	$643,320
2.	167,480	1,500	16,780	401,950	569,430
3.	122,390	2,000	15,700	490,780	613,170
4.	136,390	2,000	16,780	406,900	543,290
5.	107,230	900	18,170	407,700	514,930
6.	111,230	900	19,590	420,020	531,250

[1] 8% oil, 10% gas, 7% electric fuel differential escalation rates, and 10% discount rate. Factors of 23.07 (oil), 30.00 (gas) and 20.388 (electric), and 9.891 (maintenance cost).

6.2.1. CENTRAL HEATING PLANT IN BUILDING 1 (COMMANDING OFFICER'S HOUSE)

Installation of two fossil fuel boilers in the basement of the CO's House was evaluated. The boilers would supply steam to the three major NPS buildings (1, 10 and 13). Assuming installation of double-glazing and insulation recommended in Sections 2.3 and 3.3, the peak heating loads for these buildings are roughly 430,300 Btuh, 250,000 Btuh and 919,700 Btuh for Buildings 1, 10 and 13, respectively, gross which requires a boiler capacity of 2,128,000 Btuh. Each boiler would be sized for 2/3 of this capacity for redundancy, or 1,400,000 Btu/hr each.

The new boiler room would be located in the CO's House, basement room B09. The plant layout is based on the use of cast iron sectional steam boilers which can be brought into the building through existing doorways and assembled in the house. Burners would be dual fuel for both oil and natural gas firing. This new central plant would require installation of boilers, piping and valves, underground steam and condensate lines, and either an underground oil storage tank or gas service.

Air Supply: The existing chimneys venting fireplaces on the first and second floors of the wing appear to be sufficiently large and would be adapted to serve the boilers. Some structural modifications would be required to connect the flues from the boilers to these openings. Brickwork at the basement ash pits would be removed and connections would be made from the boilers to two existing flues. Combustion air supply would be provided from a 2.8 square foot opening. A louver in the existing window will supply the required fresh air for operation of both boilers simultaneously.

Fuel: Oil consumption was estimated at 3,500 gallons for an average 20 day period in January, at normal boiler loads. In order to provide for acceptance of full-tank truck deliveries (5,000 gallons), the recommended tank size is 6,000 gallons. Installation is recommended underground, near the drive to the garage.

Natural gas could be used in lieu of oil. The latest

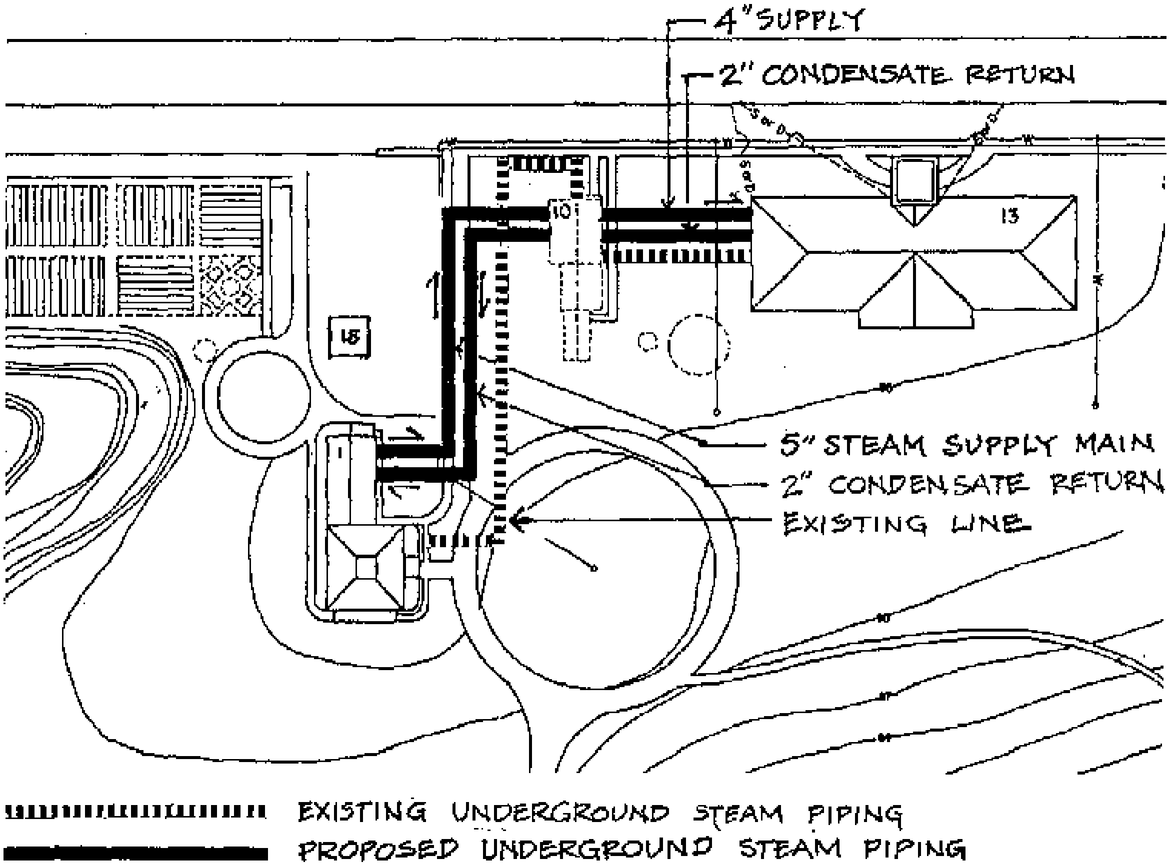


Figure 20: Underground steam piping connecting central heating plant in C.O.'s House (Building 1) with Main Arsenal (Building 13) and Master Armorer's House (Building 10, original location).

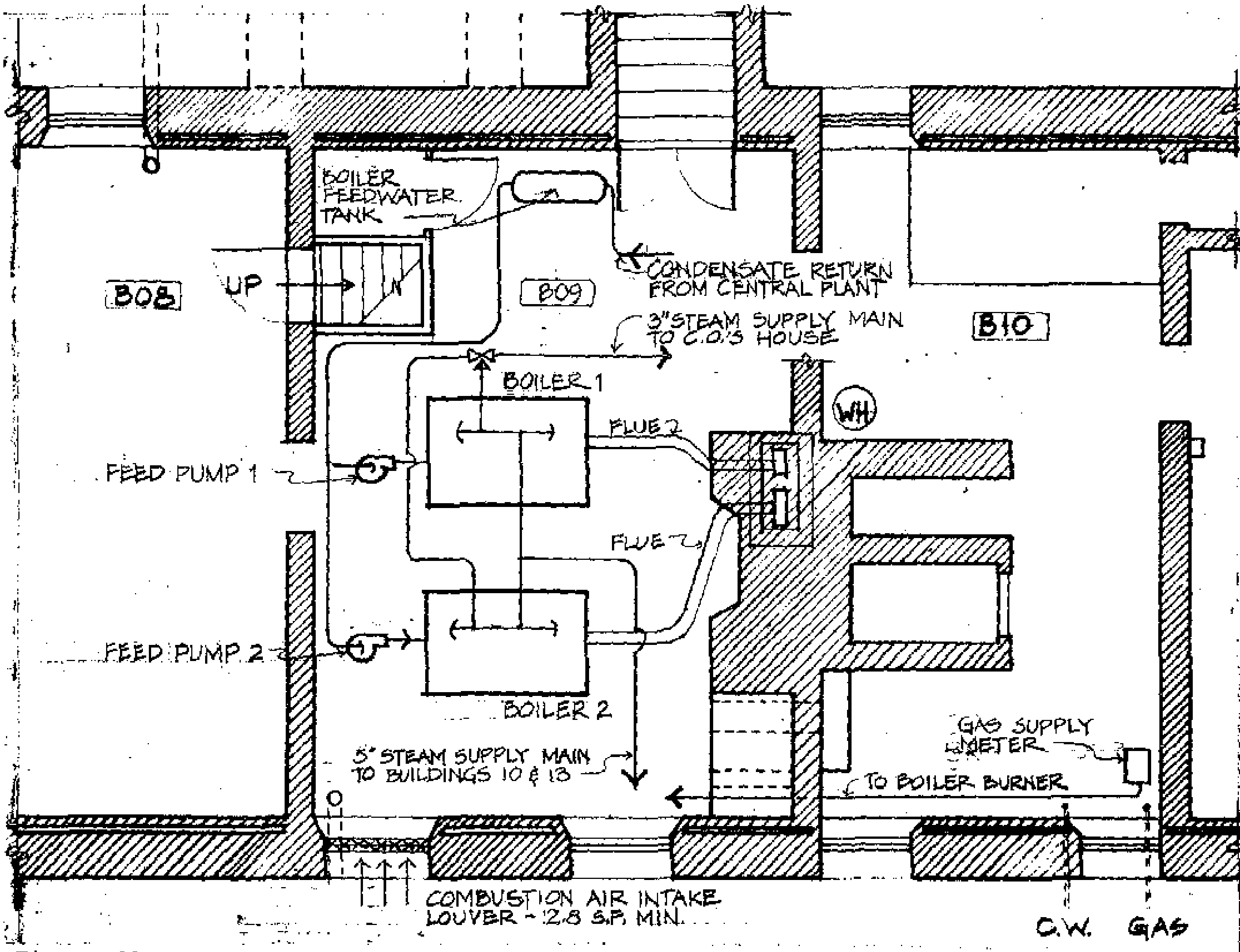


Figure 21: Boiler room layout for central heating plant in the basement of the Commanding Officer's House (building 1).

Department of Energy findings that natural gas is relatively abundant and that the Northeast is highly dependent upon imported oil support at least the consideration of gas as a fuel. Gas service is available from the Bay State Gas Company, from mains on State Street, at 1/4 psig pressure. Approximately 900 feet of 6" underground piping would be required to supply gas to the plant. The gas company would bring service to the building; installation costs would be negotiated. Alternatively, it may be possible to reactivate the existing gas service which is apparently connected to the College's 25 psig main, by negotiating with the College.

Plant Layout: A sketch of the proposed heating plant is shown in Figure 21. A 4" steam supply main would run from the boilers through the southeast wall of the CO's House, to Building 13 (and Building 10 if relocated). The condensate return would be pumped back from each building to a feedwater tank.

Underground steam piping for this system is detailed in Figure 20. A dotted line shows the existing underground lines which will be abandoned. (Repair of existing lines and installation of new condensate return lines was considered infeasible for use with a new system.) The recommended piping is shown as a solid line. The total length of piping, including condensate return, is estimated at 800 feet.

Heat Supply to the CO's House: The new boiler(s) would provide steam to the existing steam heating coils in the building. Each set of coils in the heating chambers would be sized for approximately 3,800 cfm of hot air at a discharge temperature of 120°F.

Underground Steam Supply to Buildings 10 and 13: A 4" steam main would enter the northwest wall of the relocated Building 10 and run along the northeast wall. A 2-1/2" branch line would supply steam at 352,110 Btuh (363 lbs of steam per hr) for heating for the building. The steam main, now 3", would continue to the northwest wall of Building 13.

6.2.2 CENTRAL SOLAR HEATING SYSTEM

Installation of a solar space heating system for use in conjunction with boilers would require the use of hot water as a heating medium instead of steam. The HVAC distribution systems would therefore be fan coil units in the Arsenal and hot water heating coils in the CO's House. A 4,760 square foot collector system would supply 585 x 10^6 Btu's annually, or roughly 20% of the two buildings' heating requirements. The collectors would be located as shown in Figure 10. A 7600 gallon underground storage tank would be required. Installation costs are estimated at $419,900 and annual savings of $2,250 should be achieved. The system does not show payback within its estimated 30 year lifetime.

6.3 ENERGY MANAGEMENT SYSTEM

Installation of an energy management system incorporating heating, ventilating and air conditioning control as well as fire detection and security systems was evaluated for the Springfield Armory. Normally, such systems are used for large buildings or building complexes which warrant continous attendance. Under such circumstances the fire alarm and security tie-in would be considered additional functions which are readily connected.

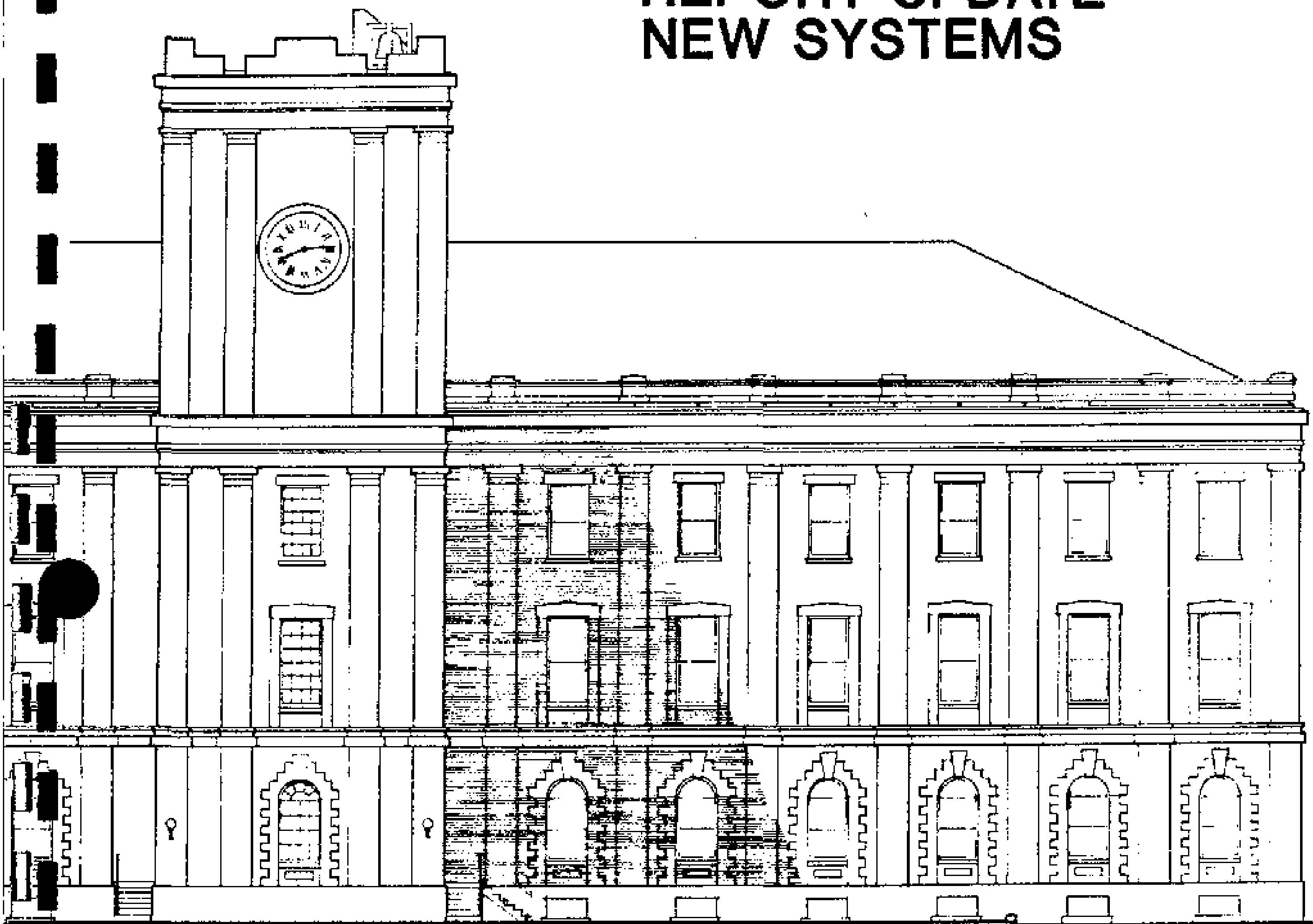
The Springfield Armory is a relatively small complex to warrant consideration of an energy management system. Since there will not be site personnel available at a 24-hour monitoring station, the management system would be switched to the present ADT system after normal working hours. An energy management system (at an investment cost of $111,100 or more) is probably not cost effective for an installation whose first cost is on the order of $400,000. The savings involved would be relatively small compared with local control systems. The automation system would be relatively expensive and impractical and is not recommended.

APPENDIX B-2

BUILDINGS SYSTEMS ANALYSIS AND RECOMMENDATIONS
UPDATE

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

REPORT UPDATE NEW SYSTEMS



BUILDING SYSTEMS ANALYSIS AND RECOMMENDATIONS

prepared for the

National Park Service

by

Stull Associates, Inc.

R. G. Vanderweil Engineers, Inc.

Stull Associates, Inc.
Architects and Planners

100 Boylston Street
Boston, Massachusetts 02116
617-426-0406

April 9, 1980

Mr. Richard Turk
National Park Service, DSC, TNE
755 Parfet Street
Dever, Colorado 80224

Re: Basic Agreement - CX-2000-8-0044
Work Directive - 8-0044-80-05

Dear Mr. Turk:

We are pleased to submit our final version of the Building Systems Analysis and Recommendations Report Update. Addenda distributed and comments received at the March 20 meeting have been incorporated. With that meeting behind us, the following findings of the report seem most significant.

By far the most economical fuel is natural gas; heating oil prices have soared in the last year, and electric prices have also risen. The gas company has stated that they are not taking on new customers unless at least 33% of the gas consumed is for uses other than heating. (See letter, appendix A.) NPS will be pursuing an agreement with the gas company which will permit them to use gas fired boilers; we thoroughly concur with this decision.

Individual heating plants are more economical than the central plant and will permit NPS to lease Building 1 without cost to the Department's energy budget. Individual plants will require some modifications to both buildings, but will avoid trenching between the buildings for a steam supply main.

Since the decision has been made not to use electric boilers, adequate electrical secondary service is available from the existing network. NPS will be undertaking preliminary archaeological investigations to determine whether the most direct route for the cable duct (scheme 3) is historically sensitive.

NPS appears inclined to stay on the water service loop of the Springfield Technical Community College. We concur with this decision from the point of view of reliability.

The principal architectural/historical impact on the existing buildings will be made by installation of a new flue. At the C.O.'s house, the flue can be tied in to an existing chimney, so there will be no visible changes to the building. At the Arsenal there will have to be a new (metal) chimney; the report discusses various ways of concealing it.

If NPS decides on an option which includes a flue in the Arsenal, which seems likely, we would recommend a programming and schematic design phase to coordinate flue location with services anticipated in the next phase of design. For example, it is suggested that the location of the flue anticipate the need for a mechanical core (containing plumbing and electrical risers and heating and A/C equipment as well as the flue). Concern about the visibility of the flue at the roof may be more sensibly resolved if it is considered along with the possible need for toilet exhaust venting, elevator shaft venting, and ventilation of laboratory equipment.

We trust that this report has been helpful in clarifying the issues and bringing the Park Service to a decision.

Very truly yours,
STULL ASSOCIATES, INC.

Elinore Charlton

Elinore Charlton

EC/al

REPORT UPDATE - NEW SYSTEMS
BUILDING SYSTEMS ANALYSIS AND RECOMMENDATIONS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

prepared for the
National Park Service
Basic Agreement No. CX-2000-8-0044
Work Directive No. 8-0044-80-05

April, 1980

by
Stull Associates, Inc.
100 Boylston Street, Boston, Massachusetts

and
R.G. Vanderweil Engineers, Inc.
52 Chauncy Street, Boston, Massachusetts

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APPENDICES

1. Introduction and Summary

The purpose of this brief study is to lay out the options for the Park Service if it desires to install its own services and terminate its dependence on the College.

The Main Arsenal (Building 13) and the Commanding Officer's House (Building 1) at the Springfield Armory National Historic Site are presently tied in to the utility distribution systems of Springfield Technical Community College. Steam for heating, water (separately metered) and electricity are purchased by NPS from the College. (The Armory uses no gas.) The systems are described in detail in an earlier report Building Systems Analysis by the authors of the present report.

There are several general constraints. It is assumed that significant changes are going to be made in the not-so-distant future to the museum exhibits in the Arsenal, to the Park-as-exhibit, and to the operations of the Park. However, these new programs are still indeterminate. Therefore, NPS desires to change over to its new services with a minimum of modifications to the park grounds and the building interiors. Existing distribution systems within the building will remain unchanged in the first phase of the conversion. Again, the reader is referred to the Building Systems Analysis for a complete description of existing systems.

Because the Armory is an historic site, any work done on the grounds or in the buildings must be done with a respect for the historic integrity of the site and an understanding of the fact that the whole site is itself a museum, displaying architecture and construction and mechanical systems technology from earlier periods. Therefore, changes must be made unobtrusively, and with the least damage to existing materials. Any excavation - as for buried equipment or conduit - must be approved and supervised by Park Service Archeologists to prevent the loss of archaeological information. NPS has requested that digging be avoided in the vicinity of the Master Armorer's House and the Paymaster's Quarters which used to flank the Arsenal north and south (Fig. 1). Because the museum's collection is irreplaceable, the relative reliability and safety of the various options for the Arsenal should also be considered.

Cost estimates for installation and operation of the various heating options were calculated in March 1979, (Building Systems Analysis, Table 9, p. 95); they have been recalculated using current fuel prices and the most recent U.S. Department of Energy guidelines for fuel cost escalation rates (Table 3 in section 2 of this report).

It is expected that the choice of a heating system will not be made on monetary costs alone, but will also take into account impacts on the site and buildings. With this in mind, a summary of work required for each option has been compiled in Tables 1 and 1a. Figure 1 summarizes the site utility routing options. Impacts are discussed at greater length in the report.

TABLE 1A: UTILITY TRENCH DIMENSIONS

UTILITY	PIPE OR DUCT BOX DIMENSIONS	DEPTH OF COVER	OVERALL TRENCH DIMENSIONS
GAS	6" dia.	3'	3½'d x 2'w
ELECTRICAL			
1200 amp	25" x 24"w	3'	5½'d x 2'w
600 amp	18" x 24"w	3'	5' d x 2'w
15 KV	10" x 18"w	3'	4½'d x 1½'w
WATER			
sprinkler & domestic	8" main	5'	6'd x 2'w
domestic only	4" main	5'	5½'d x 2'w

Two other considerations may affect NPS's final decision: reliability and safety. Reliability: A constant 24 hour temperature should be maintained for the exhibits. An electric heating system is susceptible to a power failure, as are the pumps, controls, etc. for a fossil fuel system. An emergency generator can be provided for pumps and controls to maintain a fossil fuel heating system during a blackout; a generator sized to provide electric heat would not be reasonable. Natural gas is less susceptible to interruption of supply than oil since its source is

TABLE 1: SUMMARY OF HVAC FUEL SUPPLY AND EQUIPMENT OPTIONS

OPTION		BOILER ROOM	FLUE	GAS[a]	OIL[b]	ELECTRIC[a]
1.	CENTRAL GAS IN CO'S HOUSE	B09 8 modules; steam pipe to Arsenal (d)	New metal flue tied in to chimney at attic	New service	None	600 amp seconday from Byers St. to electric room in Arsenal, serving both buildings.
2.	CENTRAL OIL IN CO'S HOUSE	B09 8 modules; steam pipe to Arsenal (d)	as for 1	None	7500 gal. tank	as for 1
3.	GAS IN CO'S HOUSE	B09 (B11) 2 modules	as for 1	New service	None	as for 1
	GAS IN ARSENAL	Boiler room in basement, 5 modules	Factory built metal flue	New service	None	as for 1
4.	OIL IN CO'S HOUSE	B09 (B11) 2 modules	as for 1	None	3000 gal.	as for 1
	OIL IN ARSENAL	Boiler room in basement, 5 modules	Factory built metal flue	None	7500 gal. tank	as for 1
5.	GAS IN CO'S HOUSE	B09 (B11) 2 modules	as for 1	New service	None	Service from Arsenal
	ELECTRIC BOILERS IN ARSENAL	Boiler room in basement, 5 modules	No flue	None	None	15KV primary from State St. to transformer (c); electric room in Arsenal serving both buildings.
6.	OIL IN CO'S HOUSE	B09 (B11) 2 modules	as for 1	None	2000 gal.	Service from Arsenal
	ELECTRIC BOILERS IN ARSENAL	Boiler room in basement, 5 modules	No flue	None	None	as for 5

Notes:
(a) Trench required for utility. See Table 1A.
(b) Oil tank to be buried on site.
(c) Transformer to be buried on site.
(d) Central plant requires buired steam and condensate piping between buildings.

mainly domestic. Safety: Fire is possible with any of these systems but detection devices, a fire suppression system, and fire enclosures would minimize damage. While the installation would include all available current safeguards, natural gas does have the possibility of explosion.

Inquiries to the NFPA, the American Boiler Manufacturers Association and Factory Mutual Insurance gleaned the following information on the relative safety of fuels:

1. Generally, electric is not counted as a fuel source so hazard statistics are not available.
2. A study of incident (of fire and explosion) frequency rates with gaseous, liquid and solid fuels showed that rates seemed to be equal.
3. Factory Mutual does not apply differential insurance rates based on fuel source. Again, the implication is that the hazards are equal.
4. More important than the fuel source in controlling safety are the system, its installation and controls, and maintenance and operation.

Finally, the question of whether fossil fuel fumes can damage the exhibits has been asked. The boiler room should be under negative pressure so that fuel fumes will not escape into the building. As for exhaust fumes, gas burns more cleanly than oil.

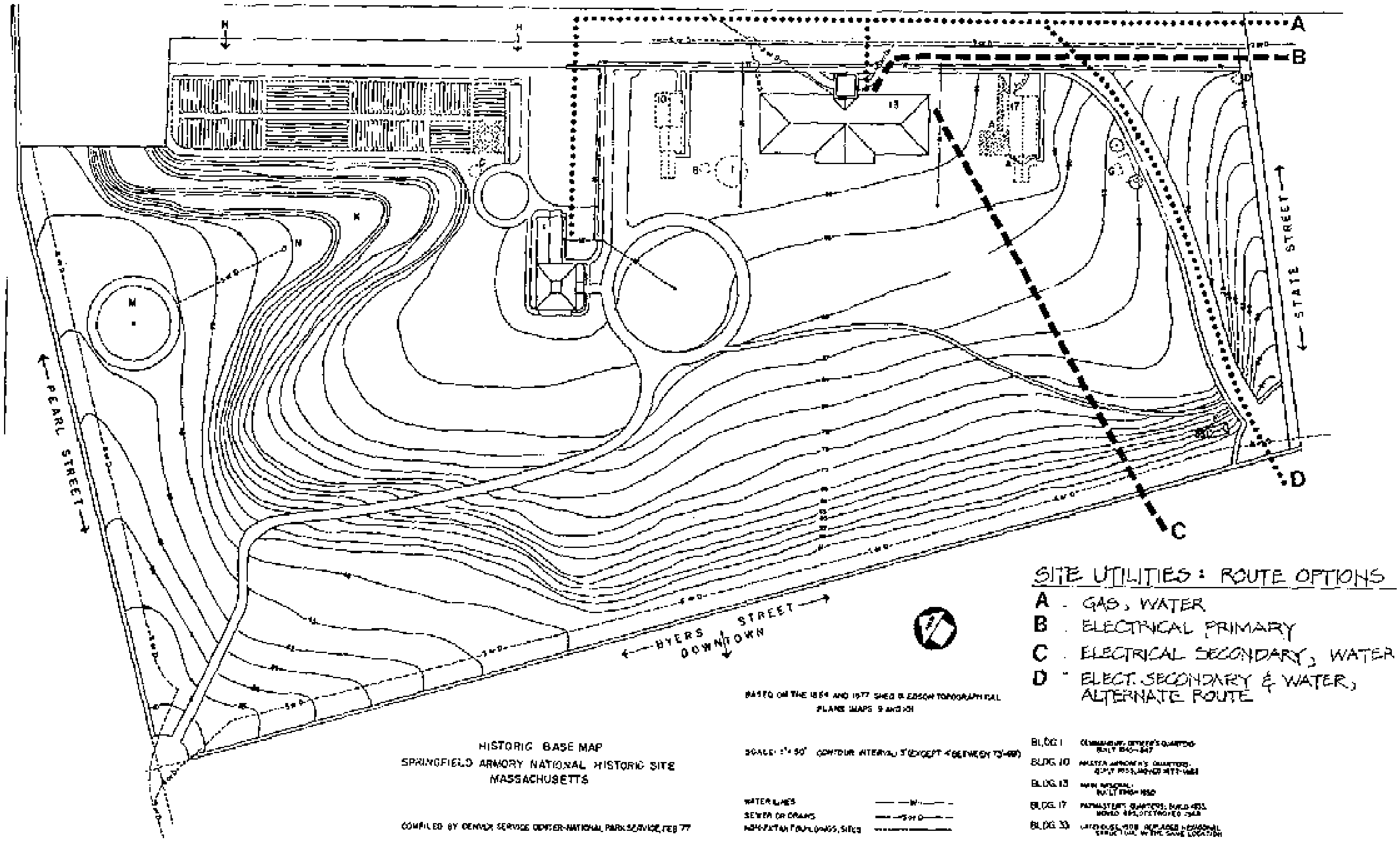

SITE UTILITIES : ROUTE OPTIONS
A . GAS, WATER
B . ELECTRICAL PRIMARY
C . ELECTRICAL SECONDARY, WATER
D . ELECT. SECONDARY & WATER, ALTERNATE ROUTE
PEARL STREET
BYERS STREET
DOWNTOWN
STATE STREET
HISTORIC BASE MAP
SPRINGFIELD ARMORY NATIONAL HISTORIC SITE
MASSACHUSETTS
COMPILED BY DENVER SERVICE CENTER-NATIONAL PARK SERVICE, FEB 77

FIGURE 1

2. Heating System

2.1 DESIGN CRITERIA

Maximum heating loads have been recalculated for both buildings using ASHRAE 90-75 and recommended indoor design temperatures of 68 degrees. (It was assumed that heating and cooling temperature restrictions currently in effect are on an emergency basis and are not necessarily to be used for design.) Since criteria for most museums, including gun collections, call for relatively constant conditions with no abrupt temperature changes rather than an absolute temperature level, it is assumed that 68 degrees will be adequate. This is likewise true for the design relative humidity in the arsenal, which will be maintained at about 40% in winter and 50% in summer.

TABLE 2: ENVIRONMENTAL DESIGN CRITERIA USED IN SIZING HEATING SYSTEM

	Arsenal Bldg.13	Commanding Officers House Bldg.1
Inside Temperature	68°F	68°F
Inside Relative Humidity	40%	-
Night Setback Temperature	68°F	55°F
Return Air	-	System modified to close off fresh air openings & return 100%
Outside Temperature	2°F	2°F
Infiltration	½ Air Change/HR	½ Air Change/HR
Process Exhaust	1000 CFM	-
Areas Heated	All	All

The following assumptions have also been made with regard to the equipment requirements for the Armory buildings:

1. New modular steam boiler units will be installed. (See Appendix C for a description of Hydrotherm units, taken as typical in this report.)

2. The new boilers will be connected to the existing 8" steam distribution mains in both buildings. A condensate return system to the boilers will be provided.

3. Existing heating equipment will continue to be used in this phase. In the Arsenal existing equipment consists of pipe radiators in the basement and four heating units on the first and second floors. In the C.O.'s house, the air heating chambers with steam coils and the existing radiators in the wing will be reused.

2.2 SUMMARY OF OPTIONS

The options analyzed in the report of March 6, 1979 were:

1. Central plant in C.O.'s House - Gas Fired
2. Central plant in C.O.'s House - Oil Fired
3. Individual gas-fired boiler plants in each building
4. Individual oil fired boiler plants in each building
5. Gas-fired boiler in C.O.'s House and electric boiler in Arsenal
6. Oil-fired boiler plant in C.O.'s House and electric boiler in Arsenal

These options were reanalyzed on the basis of current data including updated costs for fuel and equipment (Table 3). The only major change from 1979 report is that modular boilers are including for all schemes rather than the single larger type. For the hydrotherm units described in Appendix C, it is calculated that 8 modules would be required for the central plant options; for individual plants, 5 modules would be required in the Arsenal and 2 in the C.O.'s House.

It should be noted that gas-fired boiler options continue to be included although the latest gas company policy is to restrict gas service to those customers who have at least a 33% non-space heating component. A copy of a letter from the Bay State Gas Company which states their policy is attached (Appendix A). The Springfield Armory usage would be primarily for space heating so that the Gas Company policy would preclude service to the armory.

Figures 2-5 show proposed locations of boiler rooms and heating equipment in the first phase of conversion.

2.3 COST ESTIMATES (REVISED)

The 30 year costs are calculated in accordance with the Federal Register of the Life Cycle Costing Analyses for Federal Buildings. However, the current fuel costs given in the Federal Register as generated by the Department of Energy do not agree with actual costs. Therefore, two sets of cost estimates are presented in Table 3: one (3a) based on actual costs, and one (3b) based on Federal Register D.O.E. costs.

The results of the analysis indicate that option 6, using an electric boiler plant in the arsenal and a fossil fuel fired plant in the Commanding Officer's House is the most costly. The schemes of individual fossil fuel boiler plants in each building are comparable in cost to a central plant in the Commanding Officer's House serving both buildings

Gas firing is by far the most desirable from the standpoint of cost, maintenance and preferred energy source given the current international situation in oil supplies and the indicated long term depletion of oil reserves before our natural gas reserves. Furthermore, New England is dependent on foreign oil, and natural gas is for the most part domestic so that the supply should be more stable. Also in the long term some of our plentiful coal reserves will be gasified and distributed through existing pipelines. For these reasons, pressure should be exerted on the Gas Utility Company to modify their policy and provide gas service to the Armory Buildings.

If gas is not available at present, the Park Service would be advised to keep open the option of converting to gas in the future. This could be done

TABLE 3: HEATING COSTS BY OPTION

Options

1. Gas-fired Central Plant
2. Oil-fired Central Plant
3. Individual gas-fired boilers
4. Individual oil-fired boilers
5. Gas-fired boiler in CO's House and Electric in Arsenal
6. Oil-fired boiler in CO's House and Electric in Arsenal

TABLE 3A: BASED ON ACTUAL 1980 FUEL COSTS (1)

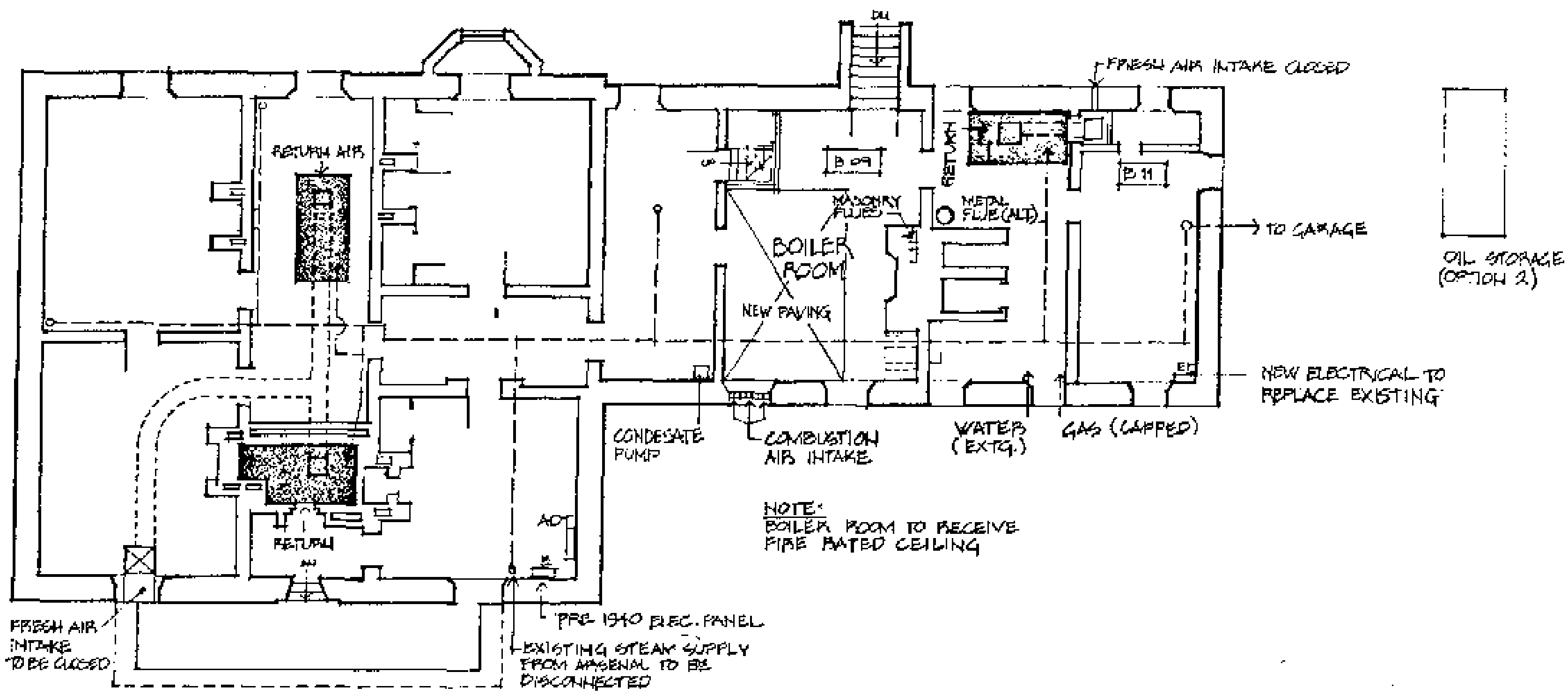
OPTION	INITIAL COST	ANNUAL COSTS MAINTENANCE	/FUEL	30 YEAR OPERATING COSTS	TOTAL 30 YR COST
1	238,000	1,600	20,660	649,310	887,310
2	177,300	2,400	36,220	1,538,850	1,716,150
3	183,200	2,200	19,270	612,880	796,080
4	156,400	3,000	33,750	1,441,340	1,597,740
5	185,900	1,200	34,620	1,079,160	1,265,060
6	144,200	2,000	38,260	1,299,360	1,443,560

TABLE 3B: BASED ON DOE FEDERAL REGISTER VOL. 45 NO. 16. JAN 23, 1980 (2)

OPTION	INITIAL COST	ANNUAL COSTS MAINTENANCE	/FUEL	30 YEAR OPERATING COSTS	TOTAL 30 YR COST
1	238,000	1,600	29,290	914,120	1,152,120
2	177,300	2,400	33,980	1,444,960	1,622,260
3	183,200	2,200	27,290	858,770	1,041,970
4	156,400	3,000	31,660	1,353,900	1,510,300
5	185,900	1,200	51,180	1,588,760	1,774,660
6	144,200	2,000	52,340	1,727,880	1,872,075

(1) Based on actual 1980 fuel costs and escalation rates from D.O.E. Life Cycle Cost Analysis Methodology (Federal Register January 23, 1980, Tables C2-8.) Fuel prices are in 1980 dollars. Cumulative factors are 41.82(oil), 30.86 (electric) and 10.00 (maintenance).

(2) Based on D.O.E. projected 1980 fuel costs and escalation rates from D.O.E. Life Cycle Cost Analysis Methodolgy, op. cit.



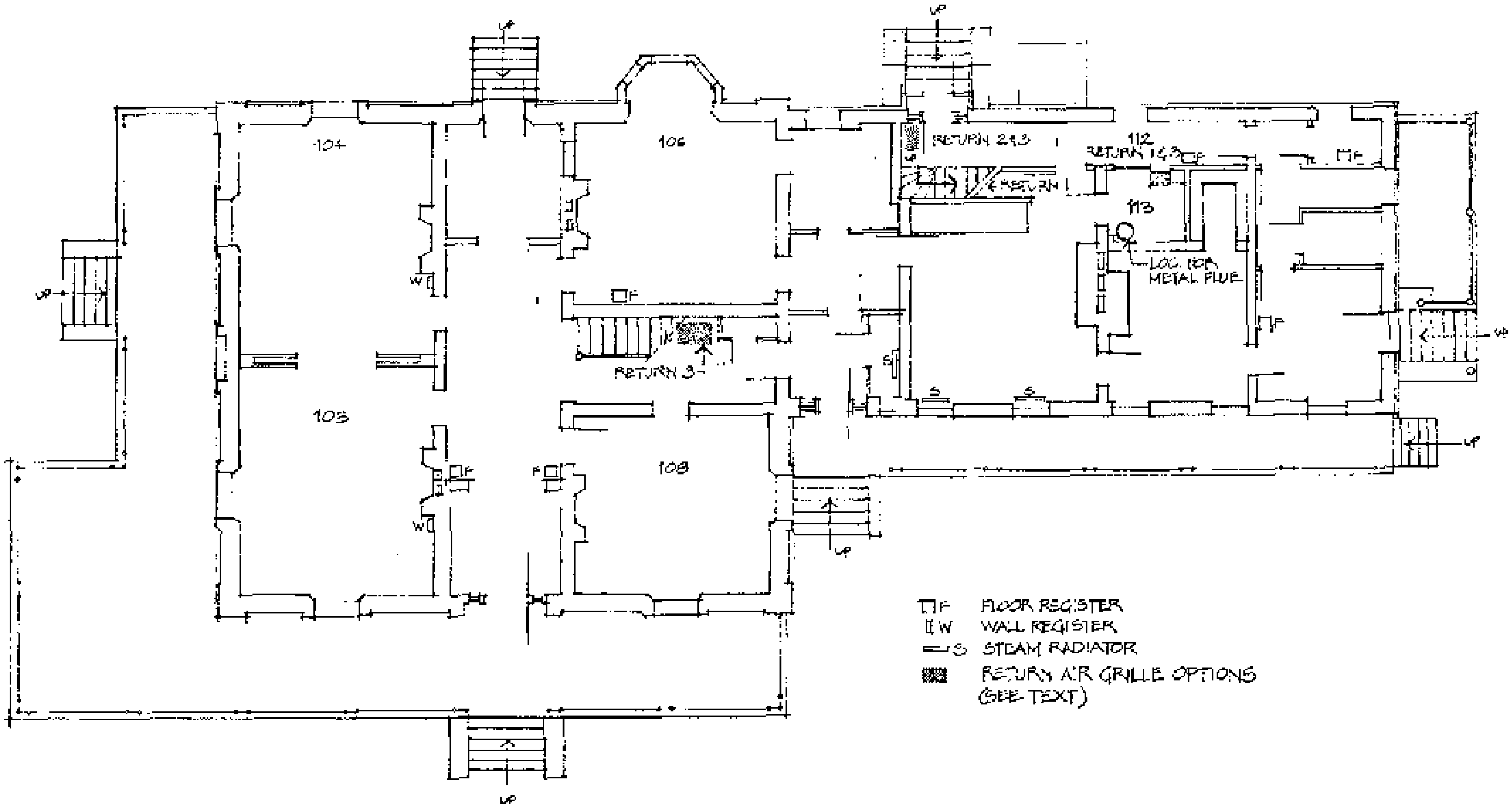
KEY:

- HEATING CHAMBERS
- PROPOSED AIR RETURN FROM FIRST FLOOR
- STEAM LINE, TO BE REUSED
- E ELECTRICAL PANEL

COMMANDING OFFICER'S HOUSE
BASEMENT PLAN

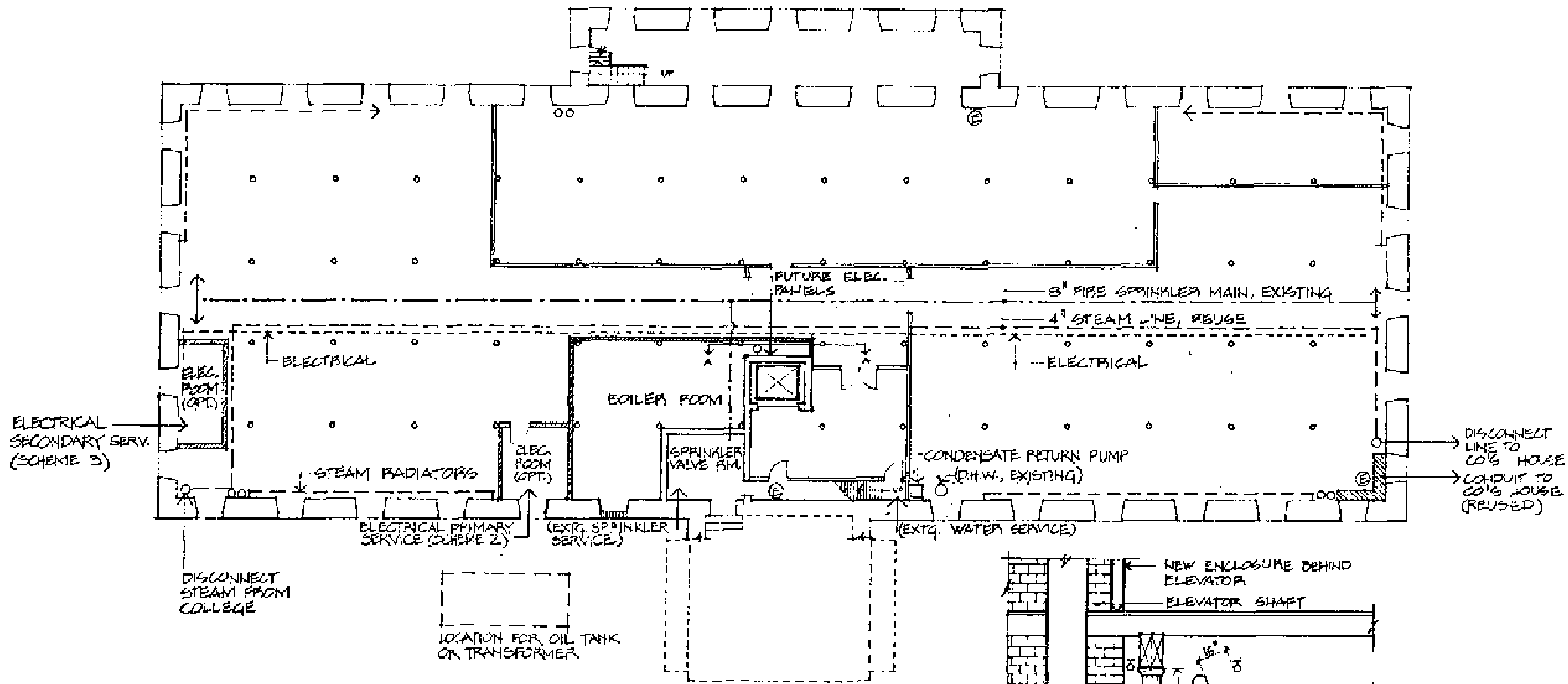
SERVICES, FIRST PHASE
CENTRAL PLANT

FIGURE 2

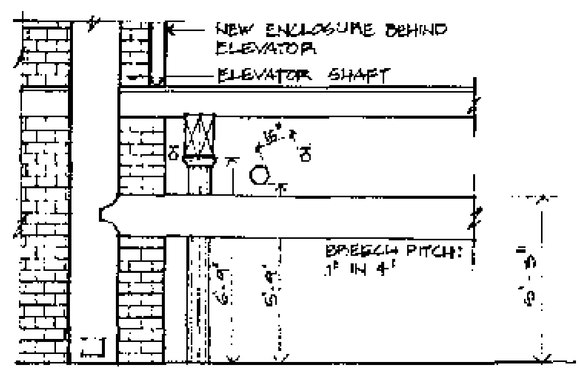


COMMANDING OFFICER'S HOUSE
FIRST FLOOR PLAN
SERVICES, FIRST PHASE

FIGURE 3

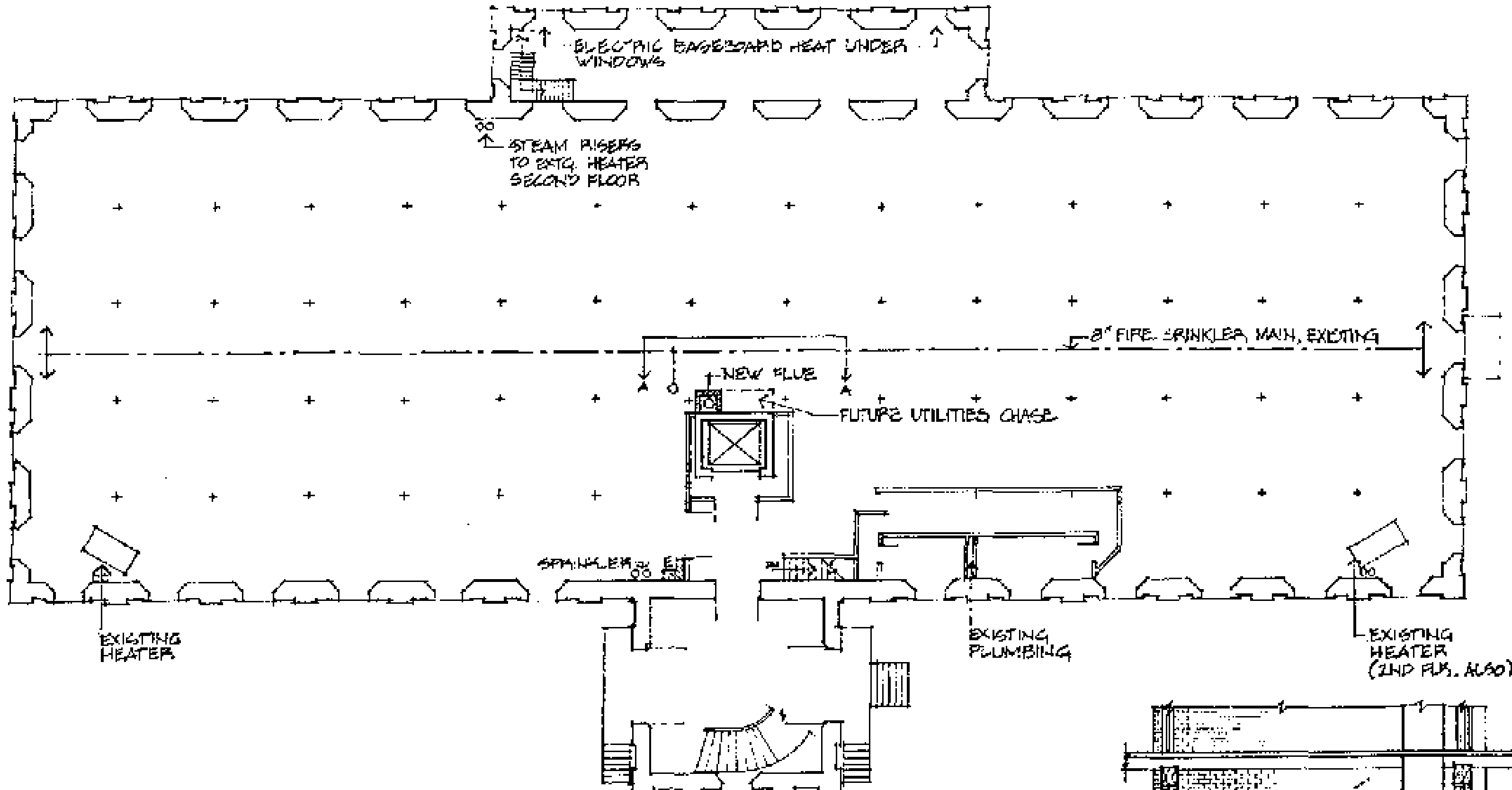


MAIN ARSENAL
BASEMENT PLAN
SERVICES, FIRST PHASE
(ITEMS IN PARENTHESES ARE EXISTING AND MAY BE RETAINED)

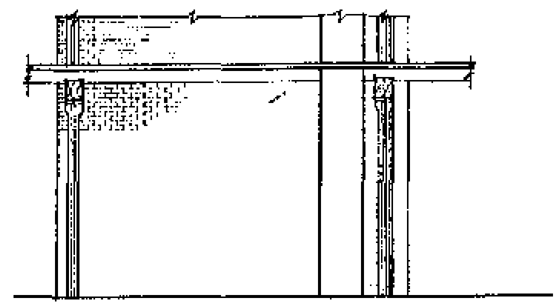


SECTION - ELEVATION A-A
SCALE: 1/4" = 1'-0"

FIGURE 4



MAIN ARSENAL
FIRST FLOOR PLAN
SERVICES, FIRST PHASE



SECTION - ELEVATION A-A
SCALE 1/8" = 1'-0"

FIGURE 5

either by installing dual fuel burners initially or by replacing oil burners in the boilers with gas burners later on. The rest of the boiler hardware (tanks, piping, flues, etc.) would remain unchanged. The initial cost differential for dual fuel vs. oil burners is high - $10,000, or 6% of the total installation cost for the oil fired plant. On the other hand, the cost of dual fuel burners is comparable to the total cost of converting later on, so the initial expense might be justified if conversion to gas in the future was judged to be likely. The prices in table 4 are based on powered gas burners with electrically operated pilot (Appendix C). It should be noted that inflation will increase the cost of equipment and labor, so that conversion will become more expensive with time.

TABLE 4: INSTALLED COSTS FOR BURNER ALTERNATIVES

	UNIT COST	CENTRAL PLANT (8 BOILERS)
Dual Fuel Burners	$1,500	$12,000
Single Fuel Burners		
Oil-Initial Installation	$ 250	$ 2,000
Gas-Replacement	$ 800	$ 6,400
Labor for Conversion	$ 200	$ 1,600
Total Cost (1980$)		$10,000

2.4 INSTALLATION AND CONVERSION

Commanding Officer's House

The present steam supply enters the building on the south side of the basement of the main part of the building. The main runs east and west feeding the three gravity warm air furnaces and the cast iron radiation on the first and second floors (Fig. 2). Condensate is wasted to the sanitary system on the south side of the building.

It will be necessary to change the pitch of the steam main feeding the easterly heating unit so the pipe will pitch in the direction of steam flow. It will also be necessary to provide a condensate return pump near the existing condensate waste outlet to return condensate to the new boilers. The arrangement of boilers and piping is indicated on Figure 6.

Main Arsenal

The existing steam line enters at the southeast corner of the Arsenal and the main runs north and south feeding the radiator coils in the basement and unit heaters on the first and second floors (Fig. 4). Condensate is now wasted to the sanitary system.

In either of the proposed boiler systems it will be necessary to make provisions for condensate return. A condensate pump will be located in a pit near the sanitary sewer outlet in the basement and pumped to the main boiler receiver. It may be eliminated in the ultimate system but this is not clear at this time.

The steam main runs near the proposed boiler room location and a connection will be made to a steam header from the boilers at this point. As in the C.O.'s House, it will be necessary to change the pitch of the steam main. The arrangement of boilers and piping is shown on figure 7.

Site

If a central plant is installed, it will also be necessary to provide steam supply and condensate return piping between building 1 and building 13. These pipes would be buried below the frost line. Considerable heat loss is expected from these pipes, which is why the central plant requires one more boiler module than the two individual plants combined.

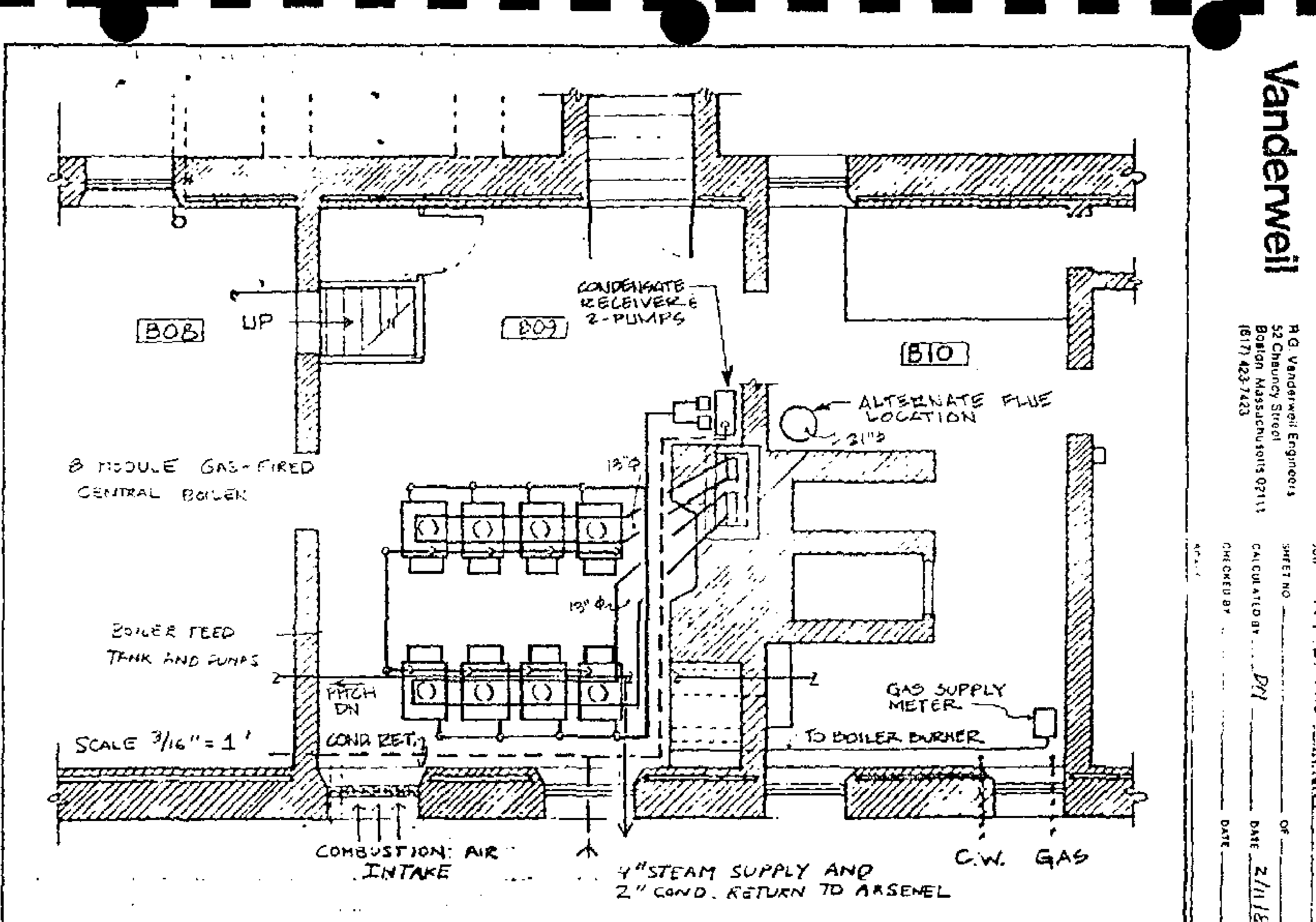


FIGURE 6: BOILER ROOM LAYOUT FOR CENTRAL MODULAR HEATING PLANT IN THE BASEMENT OF THE COMMANDING OFFICER'S HOUSE (BUILDING 1)

Vanderweil

R.G. Vanderweil Engineers
52 Chauncy Street
Boston, Massachusetts 02111
(617) 423-7423

JOB: SPRINGF...D ARMORY
SHEET NO. ______ OF ______
CALCULATED BY: DH DATE: 2/11/80
CHECKED BY ______ DATE ______
SCALE ______

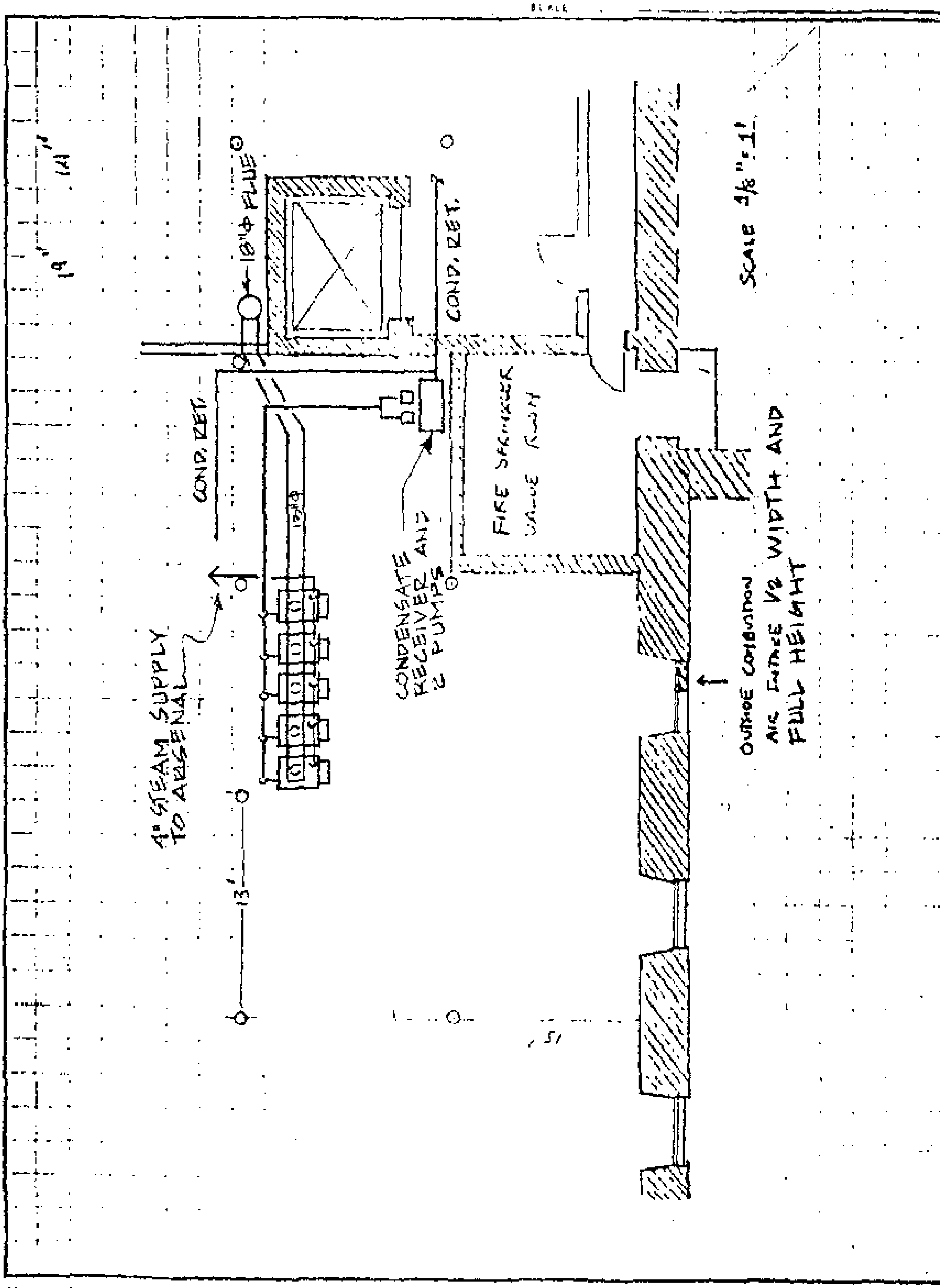
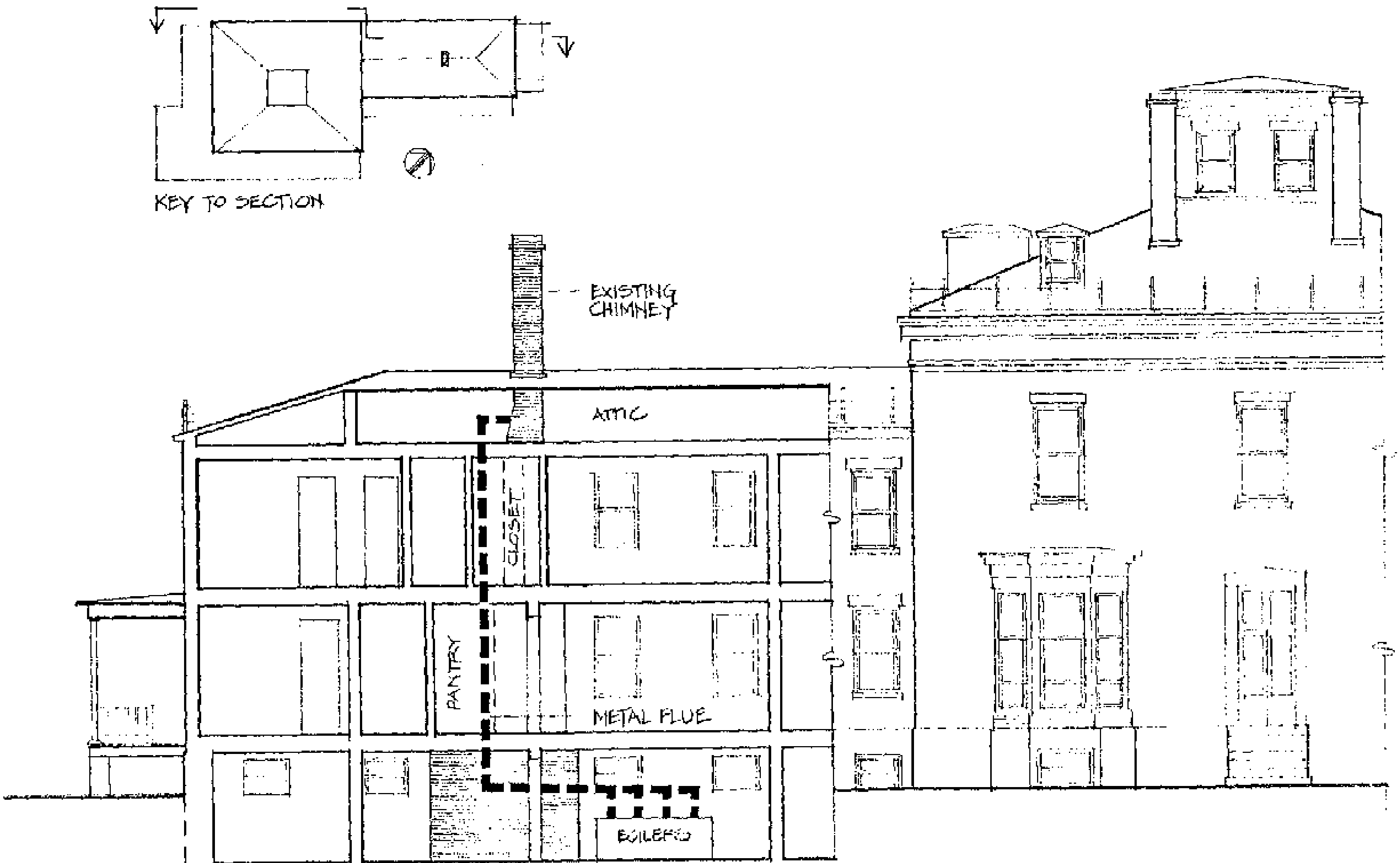


FIGURE 7: BOILER ROOM LAYOUT IN ARSENAL BASEMENT (BUILDING 13)



COMMANDING OFFICER'S HOUSE
SECTION THROUGH WING

LOCATION OF FLUE

FIGURE 8

2.5 IMPACT ON BUILDING AND SITE

For each of the heating options, a certain amount of construction is required to enclose the mechanical equipment and the fuel supply.

2.5.1 CENTRAL PLANT IN THE C.O.'s HOUSE (OPTIONS 1 and 2)

Figure 2 shows the basement of the C.O.'s House with heating option 1 or 2, gas-fired or oil-fired central plant. Flue locations shown are preliminary.

Boiler Room

For either option 1 or option 2, gas-fired or oil-fired central plant in the C.O.'s House, B09 would be designated the boiler room (Fig. 1). A battery of 8 modular boilers would be installed. Boiler modules are approximately 24"x 36"x 42" high for either oil or gas. Equipment could be brought in via the back stairs. Two windows are available to provide combustion air: the windows are under porches, so modification, such as louvres, would not be visible from the outside.

Certain modifications would have to be made to the room. Room B09 is now only partially paved with brick. The unpaved floor area (200 sq. ft. of wood tongue and groove on earth) would have to be paved either with brick to match the existing or with concrete. Brick would cost about $700 more to install. To comply with fire codes, a new ceiling with a two hour fire rating would have to be installed (probably hung) below the existing exposed wood framing. Fire doors would be installed between B08/B09 and between B09/B10. Alternatively, it might be possible to wall off the boiler area and create a separate room within B09. The space is tight, so this option requires further study.

Estimated cost of modification to B09 is $7,000.

Flue

In the previous report it was suggested that combustion exhaust could be vented via the existing masonry flue bank in Room B09. Further investigation indicates that this would be only marginally feasible. The upper end of the chimney openings, visible from the cupola, appear to be lined with clay tile, but in preliminary investigations the lower ends of these shafts appeared to be unlined. The chimney would have to be lined to comply with fire codes; to do this, the chimney would essentially have to be rebuilt as its geometry is quite tortuous. It is now recommended that a factory built metal chimney be run up to the attic with riser concealed in existing pantry and closet enclosures, and tied in to the masonry chimney just below the roof (Figure 8).

Available cross section at the top of the flues is estimated to be 250-300 in^2. A maximum flue cross section of 480in^2 (for a rectangular duct) is indicated, but this requirement could be reduced to $\pm$ 16" dia. by using a draft inducer (Appendix D).

Steam Distribution and Condensate Return

Steam generated by the boilers would be piped into the existing distribution system within the C.O.'s House. Steam mains feed finned coils in each of the three heating chambers. There are also several steam radiators in the wing. Piping slopes will need to be corrected since B11 is now the terminus rather the origin of the distribution line, but existing pipes would be reused. A new steam line from the C.O.'s House to the Arsenal would have to be provided in a trench 6 to 8 feet deep.

In both buildings condensate is presently collected in pipes at floor level and carried by gravity to the sewers. Pumps will be installed to return the condensate to the boilers. Much of the present piping inside the basement can be retained. Condensate return piping from the Arsenal to the boilers in the C.O.'s House would be buried in the same trench as as the steam main.

Gas Service (Option 1 only)

For option 1, if gas for heating only were to be made available to NPS, a new 6" gas line would be brought in a trench ($\pm$ 3.6" deep) from State Street to enter the C.O.'s House at room B09, where a meter would be installed. For installation, $28,000 is included in Table 3, initial cost.

Oil Storage (Option 2 only)

Option 2, an oil-fired central plan, would require an oil storage tank. This could be buried in the area between Building 1 and the garage. A pit 10'x 24' x 12' deep would have to be excavated, a concrete pad laid in the bottom, and a 7500 gallon tank installed (approximately a two week supply). The pit would then be backfilled and the area repaved. As with any excavation on a historic site, this would require archaeological supervision. For storage tank and piping, $10,000 is included in Table 3, initial cost.

2.5.2 INDIVIDUAL PLANT IN THE C.O.'s HOUSE

For the individual heating plant options, options 3 and 4, building 1 would be served by only two boiler modules. B11 or B09 could become the boiler room. B11 would require a fire rated ceiling to cover exposed wood framing, and a fire door. The masonry wall B11/B10 would be broken through for the flue breaching. The steam supply line from the Arsenal in Room B07 could be closed off and removed. All other construction in Building 4 would be as for option 1, except that combustion supply air and flue cross section requirements would be reduced. For option 3 new gas service would be required. For option 4, an oil storage tank of 2000 gallon capacity would suffice.

2.5.3 INDIVIDUAL PLANT IN THE MAIN ARSENAL

A heating plant in the Arsenal would require a 350-500 ft^2 boiler room in the basement and either installation of a flue to vent combustion gases or provision of sufficient electrical power to heat the boilers.

Boiler Room

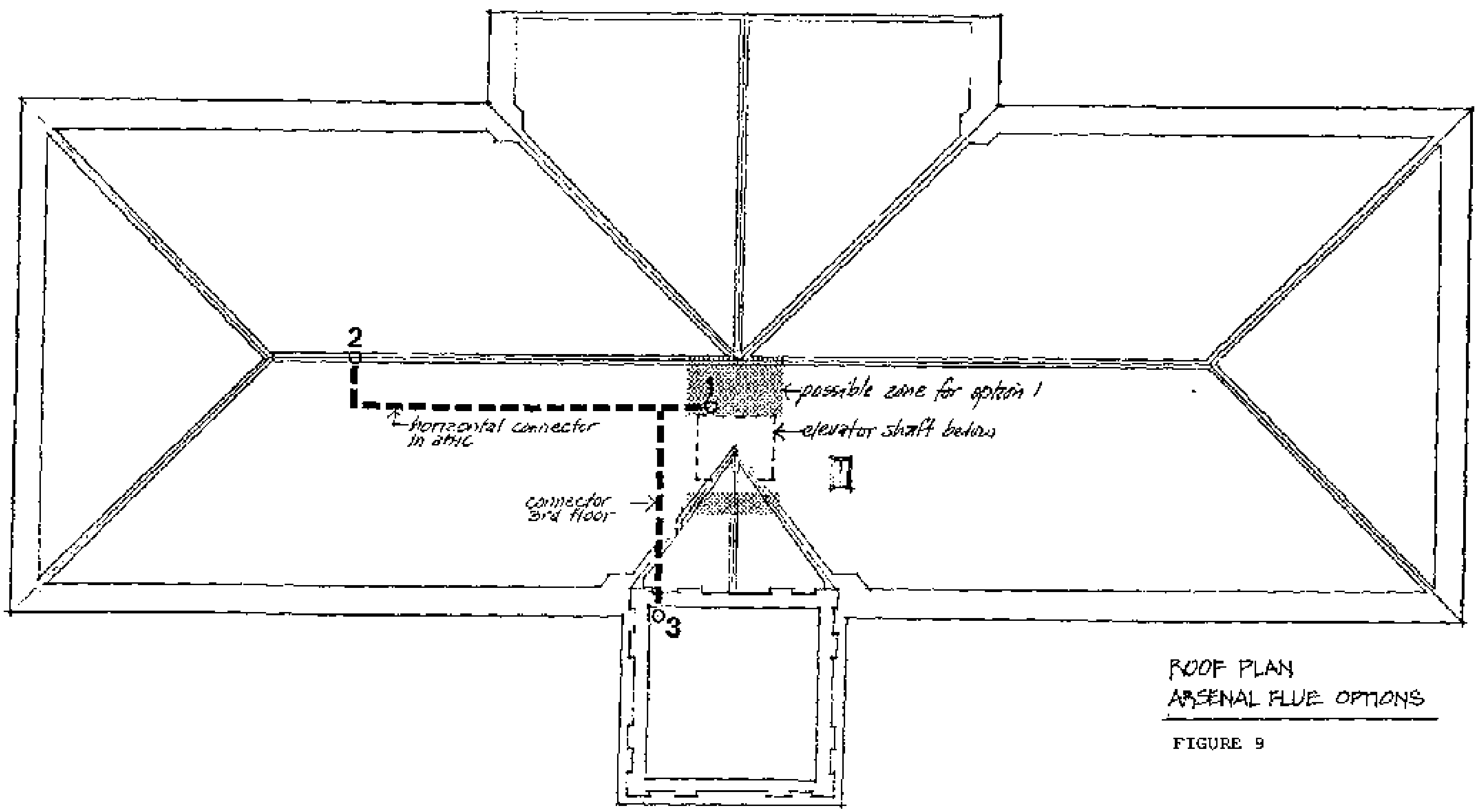
There is plenty of floor area in the basement for the boilers, and, since no program constraints have yet been defined, it seems most sensible to locate the boiler room adjacent to the other (existing) mechanical services (Fig. 4). In this location, combustion air would be obtained directly through a basement window. A two hour fired rated enclosure would have to be provided (eg: masonry block wall, fire door, and a suitable hung ceiling). Equipment would be brought into the Arsenal basement via the freight elevators; no difficulties are foreseen. Estimated cost for boiler room enclosure and ceiling is $9000.

Flue for Fossil Fuel Options (3 and 4)

A manufactured metal chimney is recommended. Vertical clearance for the breaching is rather tight -- the constraining factor is not the beams but the fire sprinkler main (5'-9" clear)-- but it is not prohibitive if the breeching is kept short to minimize the required rise. The juxtaposition of beam and sprinkler main on the north and south sides of the elevator shaft obstruct the vertical rise of a flue (detail, Fig. 4). There seems to be only one flue riser location that makes sense, and that is behind the elevator (west side). The flue would penetrate all three floors and the pressed metal ceilings. It could be left exposed or temporarily enclosed with drywall partitions. Eventually, if the museum is remodeled with a central service core (rest rooms and possibly interior zone HVAC units), other utility risers (plumbing, electrical) could be consolidated in this zone.

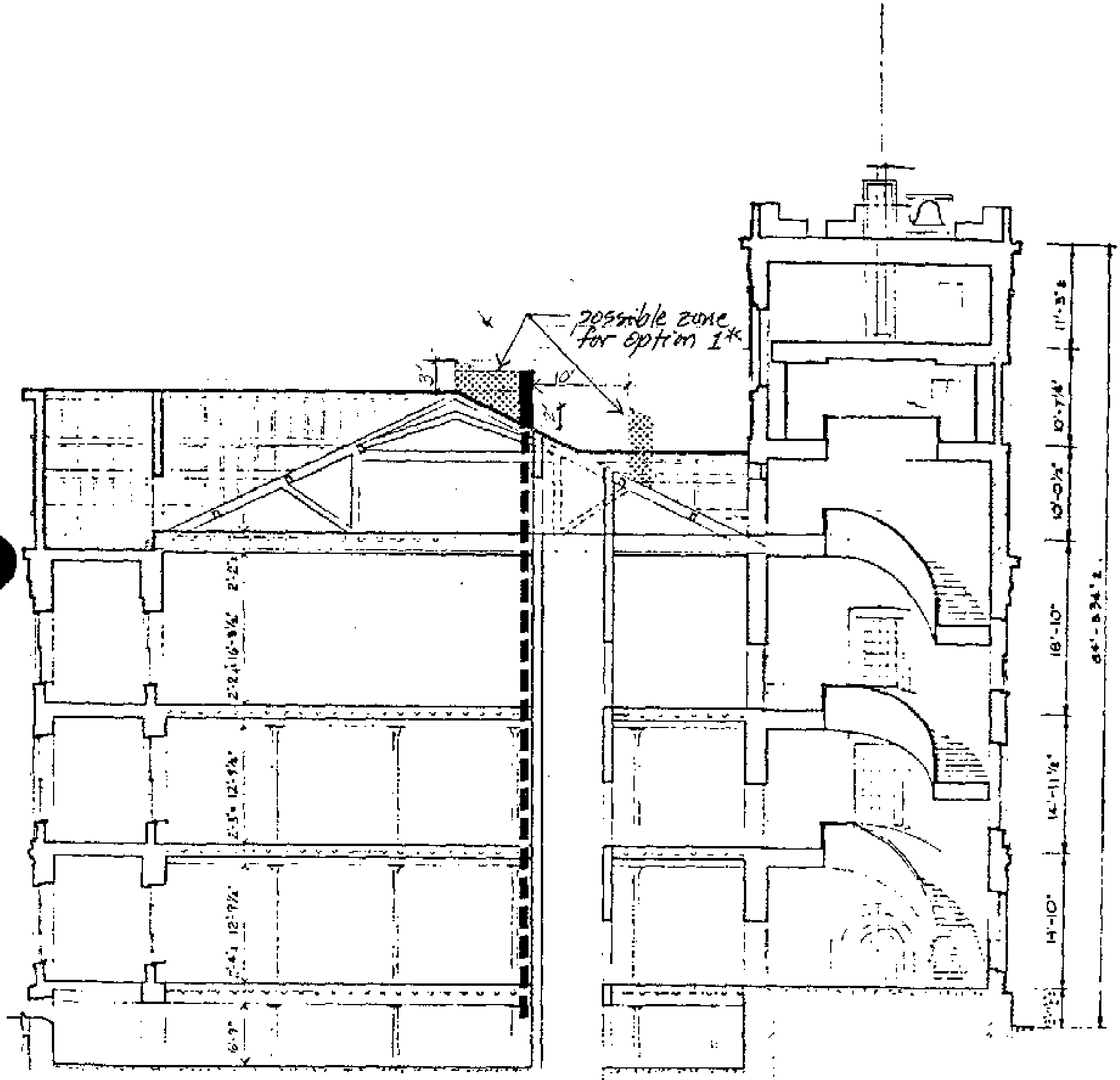
Above the third floor there are three possible ways to route the chimney to minimize its visual impact (Figs. 9, 10, 11, 12). The flue could emerge through the roof behind the clock tower, where it would be hidden from front and rear and only be marginally visible when viewed from the side (option 1). An alternative vent location was identified in the Building Systems Analysis. An old photo, ca 1880, shows that at that time the Arsenal had a pair of vents penetrating the ridge line. The flue could be shunted over within the attic to emerge at location 2, reproducing a vent. The exact location of the vents can be identified by a patch in the roof sheathing and a gap in the ridge beam. The second pipe would be reproduced for symmetry, and could eventually serve some other purpose, such as toilet exhaust.

A third possibility is to carry the flue to the tower and have it emerge at the southeast corner of the tower roof (option 3). The roof framing makes this very difficult to do within the attic, but it could be done simply below the third floor ceiling. Option 3 requires breaching the masonry tower wall with a hole big enough to pass a 20" diameter pipe and cutting holes in two additional (tower) floors.



ROOF PLAN
ARSENAL FLUE OPTIONS

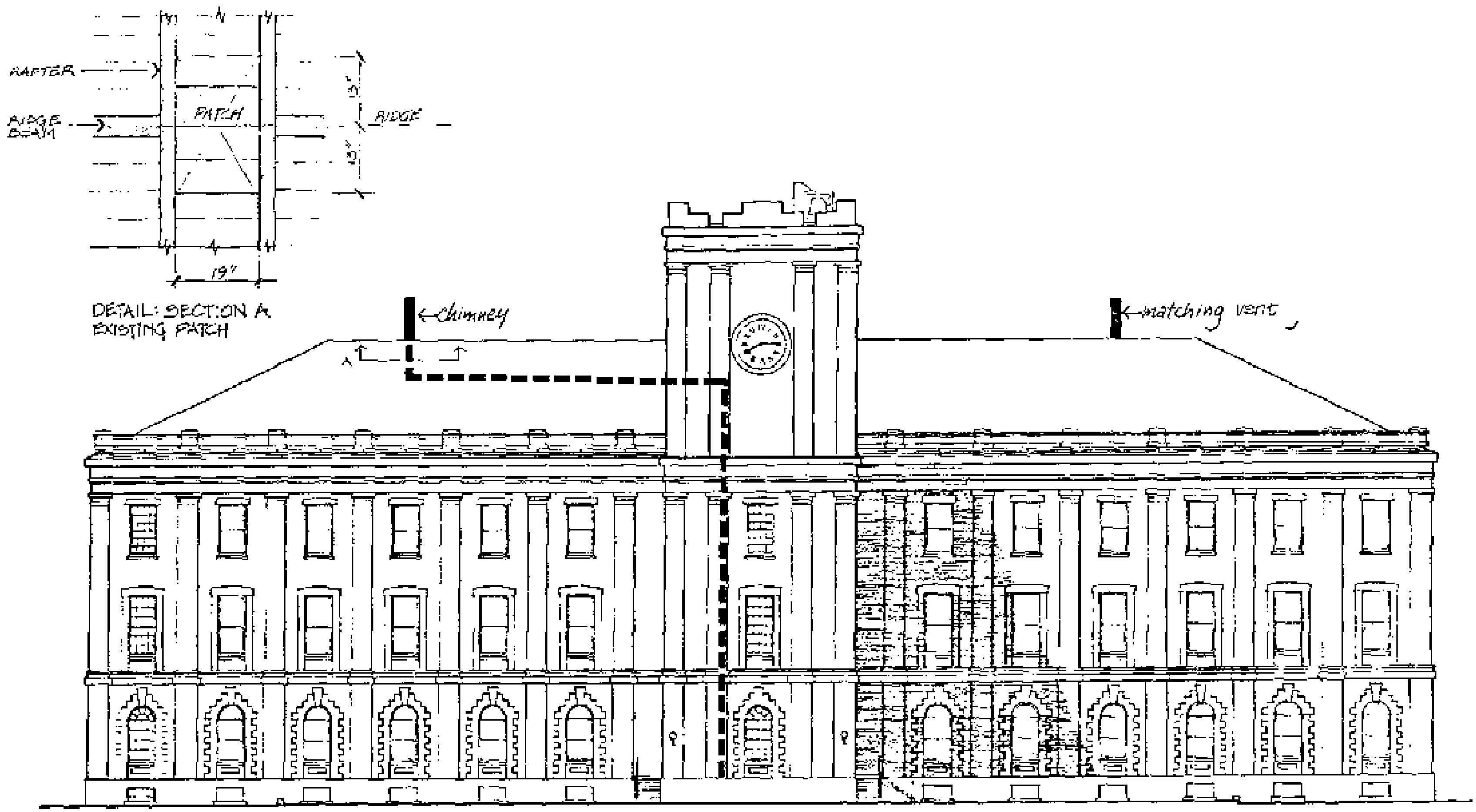
FIGURE 9



*chimney must be at least 3' high and 2' higher than any roof within 10'

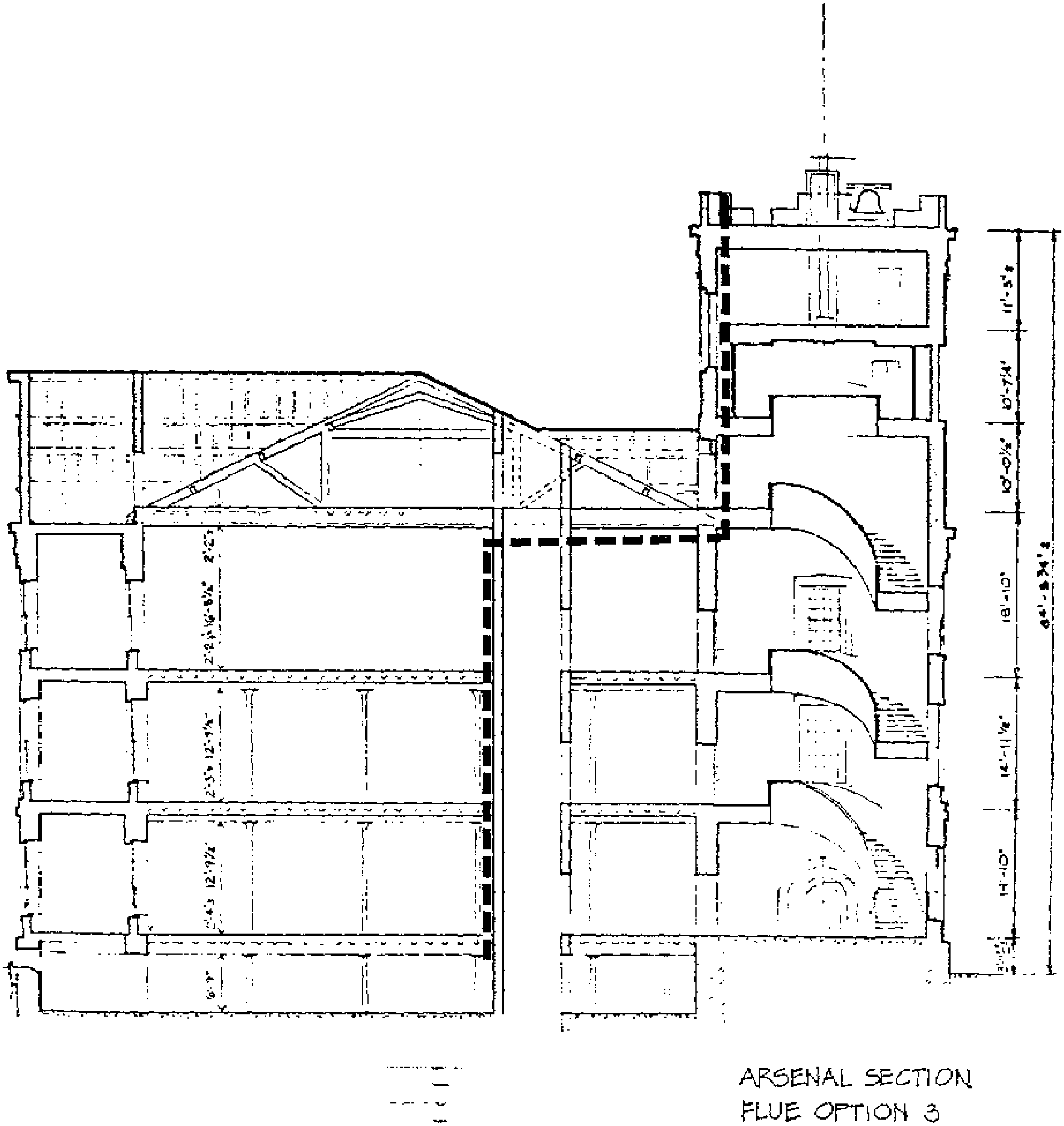
ARSENAL SECTION
FLUE OPTION 1

FIGURE 10



ARSENAL FRONT ELEVATION
FLUE OPTION 2

FIGURE 11



ARSENAL SECTION
FLUE OPTION 3

FIGURE 12

With any of the three options, a hole would have to be made in the roof to pass the flue vent; flashing and roof repairs would be required. The tower roof, which is metal, is probably the easiest to reclose; option 1 penetrating a slate roof is slightly more difficult; option 2 penetrates a formed copper ridge cap and may require more painstaking restoration. The estimated cost for cutting and patching holes in floor and roof and encasing the flue on floors one and two is $6000-$8000.

Gas Service (Option 3 only)

For option 3, if gas for heating were to be made available to NPS, a single 6" gas line would be brought in a trench from State Street, to enter the Arsenal at the boiler room, and the C.O.'s House at Room B09, with a meter in each building. Costs and other impacts of the trenching would, therefore, be about the same for the individual plants as for the central plant option.

Oil Supply (Option 4 only)

The oil-fired boiler (option 4) requires an oil storage tank. A 7500 gallon capacity, or two weeks supply is recommended. This would have to be buried somewhere on site, perhaps under the parking area, necessitating archeological review and supervision. The work required would be as described for the central heating plant option.

Electric Heat (Options 5 and 6 only)

This option would eliminate the need for a flue, but would significantly alter the electrical service requirement and could require a transformer buried on site. These requirements are discussed in the next chapter.

2.6 OPTIONAL RETURN AIR PROVISIONS FOR THE C.O.'s HOUSE

The C.O.'s House is heated by three gravity feed hot air systems. Air is heated by steam coils in three basement heating chambers and rises through ducts to the upper floors. Most of this air is then dissipated to the outside. Outside air is carried directly into the heating chambers via ducts of large cross section ($\pm$ 350 sq. in^2). Return air (basement air) can find its way into the heating chambers through small openings in the metal doors (10x 2" dia holes, or ± 30 sq. in. total).

Our previous Building Systems Analysis of March 1979 recommended revising the system to 100% return air with fresh air supplied by infiltration as in current residential systems. Cutting off the almost 100% fresh air supply will save approximately $2,000 per year with 1980 fuel costs and is therefore recommended.

Analysis of the system determines a required return air opening of six to seven square feet per heating chamber for a gravity system and two to three square feet for a system using fans and ducts to direct the air to the chambers. (Obviously, the gravity system requires substantially larger openings). There are three recommended levels of approach to return air (Fig. 5).

1. The simplest is to close off the fresh air intake, replace the doors on the heating chambers with a screened and booted duct and open the basement door. This would provide an adequate air supply to the heating chambers in the main house. However, if the boiler is in Room B09, required fire doors will separate the wing heating chamber from the open stairwell door. In this case a return would have to be installed. To minimize the size of the required return, a forced air system is recommended. A return air grille would be located in the corridor 112 with a duct in pantry 113 connecting to the air chamber below. One of the existing grilles could be copied.

   For security of the basement area, the existing door could be replaced with a louvred door, or a screened or louvred door could be added at the foot of the basement stairs.

2. The above approach uses the basement as a plenum and could pull dust from the basement into the system. Therefore, it is recommended that a filter and fan be added at each chamber. The fan would be overcoming the filter resistance, not creating a forced hot air system. Without the filters, we have avoided floor return air registers to avoid gathering excess dirt. With the filters, the return air for the wing could be located in a floor grille in corridor 112 at the foot of the second floor stairs.

3. The final approach adds to the above a 5 square foot grille (24" x 30") in the floor beneath the stair in Room 107 or within the closet in Room 107 (the closet was apparently added around the turn of the century) with ducted return to each heating chamber in the basement of the main house. This is a somewhat better return route than the basement stair: the stair route requires that many doors be left open; the hall duct gives more flexibility in closing or zoning parts of the house and allows basement security. The wing would be ducted as described above.

3. Electric System

3.1 DESIGN CRITERIA

Two possibilities are considered: one, that fossil fuel fired boilers will be used to heat both buildings (heating system options 1-4); two, that electric boilers will be used to provide steam for heating the arsenal (heating system options 5-6).

The following electric loads have been used as the basis for design:

	WITH FOSSIL FUEL BOILERS	WITH ELECTRIC BOILERS
Connected Loads		
C.O.'s House (lighting, A/C, boiler pumps, etc.)	35 KW	35 KW
Arsenal		
Lighting	40 KW	40 KW
Elevator	25	25
A/C (in future)	75	75
Boilers	10	550
Water heater	5	5
Total connected	190 KW	730 KW
Demand Loads		
C.O.'s House (65%)	23 KW	23 KW
Arsenal		
Lighting (90%)	36 KW	36 KW
Elevator (100%)	25	25
A/C (100%)	75	75
Boilers (100%)	10	550
Water heater (50%)	2.5	2.5
Total demand	171.5 KW	721.5 KW
KVA @ 0.9 Power Factor	191 KVA	802 KVA

3.2 SUMMARY OF OPTIONS

Scheme #1: Electric Boilers In The Arsenal Secondary Service

New electric service 2500A, 120/208V. 3Ø secondary from Byers St. would provide power to the Arsenal, including the new heating system and air conditioning, and to the Commanding Officer's House (Fig. 13). Work involved includes changing utility company's (Western Massachusetts Electric Company - WMECO) network transformers, trenching from Byers St. to the Arsenal, installing manholes and concrete encased conduit to contain new WMECO secondary service conductors. Interior work includes a new electric room in the Arsenal, (100-150 sq. ft.) cable duct box, new fused main switch and metering compartment, and new main distributing panel which will feed the Arsenal and the C.O.'s House after both of the existing electrical services have been removed. Total estimated cost for installation of this is $165,000.

Scheme #1A: Alternate Routing

This would provide the same service as scheme #1, except that the routing would be partly under the walkway to avoid disturbing new portions of the site (Fig. 13). This service would require longer cable runs and an additional manhole. Total estimated cost for this service is $235,000.

Scheme #2: Electric Boilers In Arsenal, High Voltage Supply With Transformer

This scheme is an alternative to Scheme #1. The service to the Arsenal would be 13,800 volts 3Ø from a new manhole on State St. via concrete encased conduit to an underground vault and transformer installed near the Arsenal (Fig. 14). The transformer would provide 480V., 3Ø 4W, 1200A service to a new fused main switch/ meter cubicle which would feed a 480V. main distribution panel. The main distribution panel would provide power to the Arsenal, including the new heating system and proposed air conditioning equipment, and to a 120/208V. 3Ø 4W. dry type indoor transformer which would provide service to the Commanding Officer's House. Estimated cost for installation of this service is $124,300.

Clearly, for heating the Arsenal, scheme 2 is to be preferred over scheme 1. It is more economical by

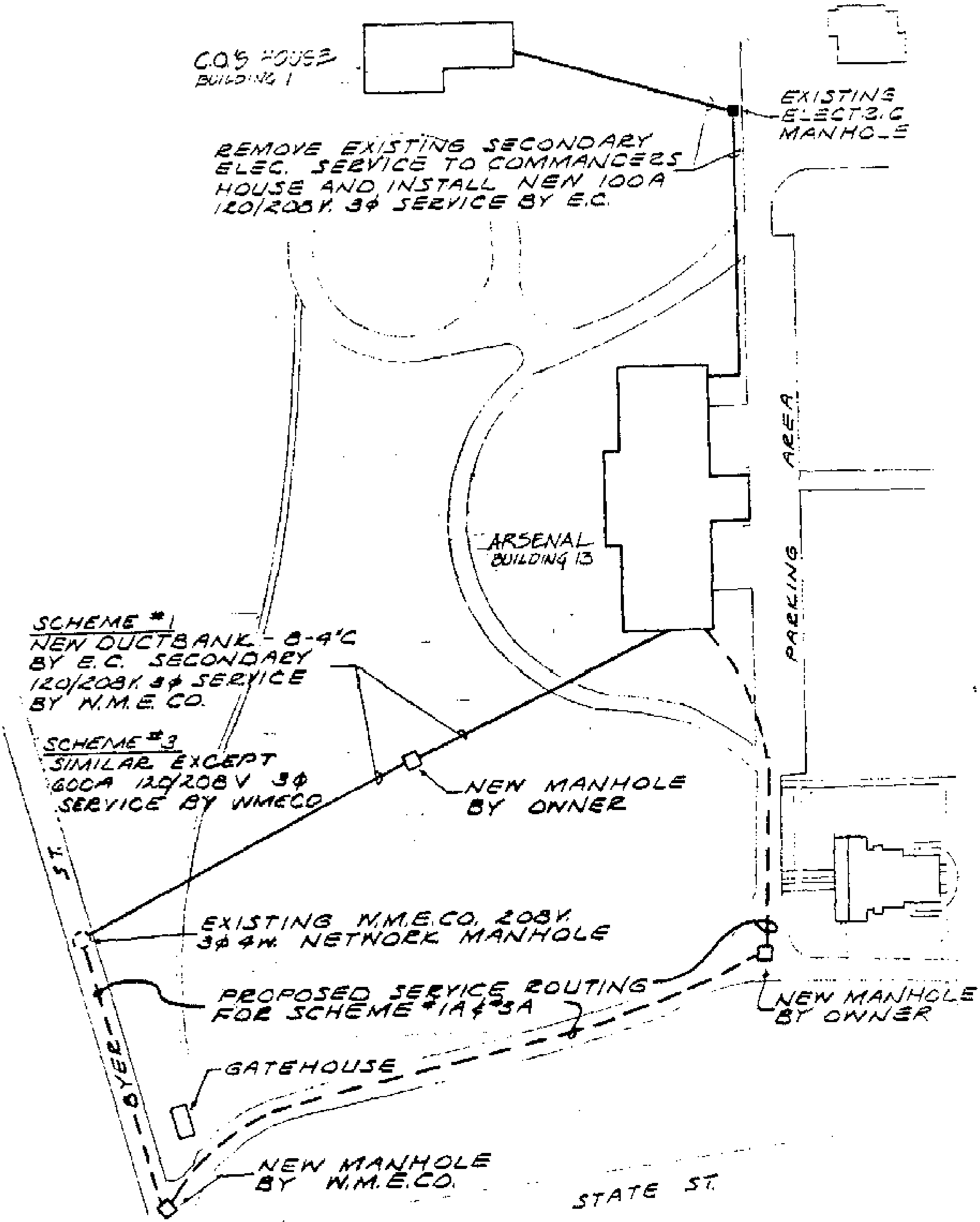


FIGURE 13: NEW ELECTRIC SERVICE, SCHEMES #1, 1A, 3, & 3A.

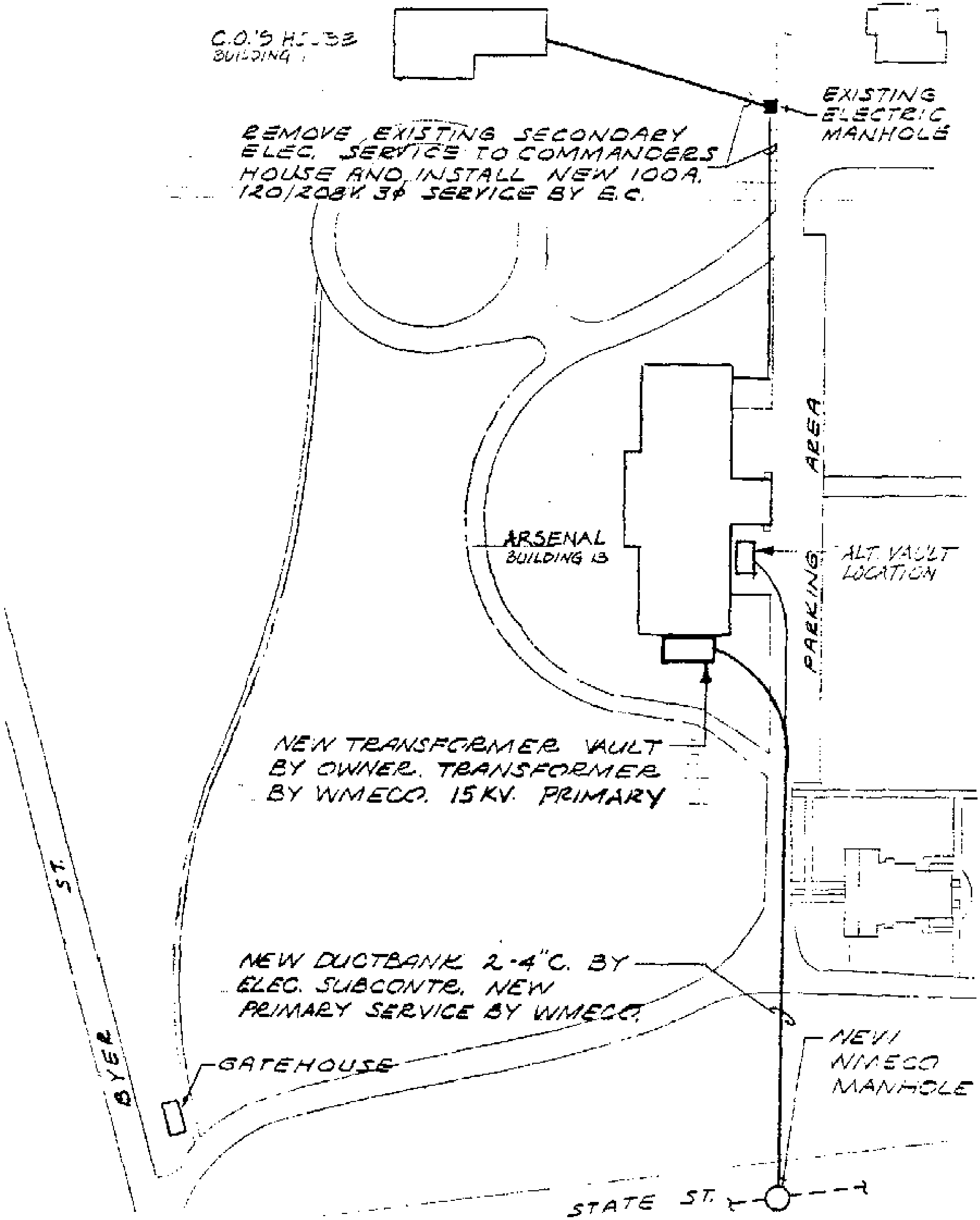


FIGURE 14: NEW ELECTRIC SERVICE, SCHEME #2.

30% and site disturbance appears to be about equal, excavation for the transformer vault (2) being balanced against the need to dig a new trench in an area previously undisturbed by site utilities (1).

Scheme #3: With Fossil Fuel Boilers

New electric service 600A, 120/208V. 3Ø secondary from an existing manhole on Byers St. would provide an electric service to the Arsenal and Commanding Officer's House independent of Springfield Technical Community College and with enough capacity for new lighting and air conditioning (Fig. 13).

Work would include trenching from Byers St. to the Arsenal and installing concrete encased conduit and a manhole to contain new WMECO secondary service conductors. Interior work would be similar to Scheme #1. Total estimated cost for installation of this service is $79,000, which includes utility company charges for work performed by them.

Scheme #3A: Alternate Routing

Service provided would be the same as Scheme #3, except that the routing would be under the walkway to avoid disturbing new portions of the site (Fig. 13). This would require longer cable runs and an additional manhole. Total estimated cost for this service is $109,000.

3.3 COST ESTIMATES

Scheme #1: Electric heat in the Arsenal, Secondary Service

Utility Co. Transformers (at manhole)	$50,000
Secondary Cables	40,000
Site Work (trenching etc.)	30,000
Interior Distribution	30,000
	$150,000
10% Escalation	15,000
	$165,000

Scheme #2: Electric heat in the Arsenal, Primary Service

Transformer at Arsenal*	$15,000
Utility Co. Manhole	15,000
15KV Cable	8,000
Transformer Vault	15,000
Other Site Work	30,000
Interior Distribution	30,000
	$113,000
10% Escalation	11,300
	$124,300

* Charge is for underground installation only.

Scheme #3: Fossil Fuel Boilers

New 600A Service Backcharge (cable, installation)	$20,000
Site Work	27,000
Interior Distribution	25,000
	$72,000
10% Escalation	7,200
	$79,200

3.4 INSTALLATION/CONVERSION

Since the Arsenal and CO's House are presently being fed from Springfield Community College, down time should be at a minimum. The site work, distribution and cabling can be installed without interrupting the existing services. When tie-in is required, the existing secondary service conductors can be disconnected to the new service. Estimated down time would be approximately three hours. This work is relatively simple and could be performed during any unoccupied hours.

3.5 ALTERATION OF BUILDING AND SITE

The most significant decision NPS will have to make regarding electrical service is whether or not to use electrically heated boilers. If electric heat is chosen, service will be run up from State Street and a transformer will have to be buried beside the Arsenal in a vault, as shown in Scheme 2 (Fig. 14). If electric heat is not chosen, service will be brought from Byers Street as in Scheme 3 (Fig. 13). The required trench will be somewhat larger and there will be a manhole on site (to facilitate pulling of cable), but there will be no transformer. All three duct bank routes avoid the old site of the Paymaster's Quarters, but Scheme 3A, no electric heat, passes through unexplored hillside and will require archeological investigation.

Concrete encased conduit for the electrical cable would be provided by NPS: the size of the trench will depend upon the type of service, being about 3' deep for 15 KV primary service and 4'-6' deep for 600 amp secondary (Table 1A). NPS would also build the transformer vault to WMECO specifications (Appendix C); WMECO would retain ownership of the transformers. The interior dimension of the vault are to be 8' x 14' x 6' -4" deep, to contain three single phase transformers. The vault would be accessed through a single manhole, 3' in diameter, which would be visible at grade. Ventilation would not be required. Possible vault locations are shown in Figs. 5 and 14.

Regardless of which scheme is chosen, secure enclosure for the electrical equipment in the basement of the Arsenal would be required; conformance with the Massachusetts electrical code is advisable. In addition to security, the principal requirements are a location at the point of entry of the electrical service and isolation from any water or steam lines. The only two feasible locations are shown in Fig. 4: one corresponding to scheme 2, electric boilers, and one corresponding to scheme 3, fossil fuel boilers. Most of the basement wall space is preempted by existing steam pipes.

The enclosure for an electrical room of 100-150 sq. ft. is estimated to cost $7000.

Within the Arsenal, electrical service would be distributed from a central conduit under the ceiling to existing electrical panels. Conversion to a new distribution system later on would be simple; new electric panels and conduit risers could be consolidated in the vertical zone behind the elevators (Fig. 4-5).

Electrical service to the Commanding Officer's House would continue to originate from the panel at the north-west corner of the Arsenal. It is expected that the new cable can be pulled through the existing conduit to the southwest corner of the C.O.'s house wing and connected to the existing main disconnect switch. No electrical room is required in the CO's House and no alterations.

4. Water Service

The existing fire protection and metered domestic water service to the Armory buildings is supplied from the 8" college loop, located in the parade area, which has a 3 way feed from the Springfield water supply in State, Byers and Pearl Streets. The following analyses deal with divorcing the Armory buildings from the college supply loop.

The options analyzed are 1)a single fire and domestic supply from State or Byers Streets (3 possible routes), 2) the addition of a secondary supply from Pearl Street connecting with any of the 3 primary routes, and 3)a single domestic only supply leaving the fire protection supply connected to the college loop.

Consideration was given to reducing the size of the fire protection supply from 8" to 4" by modifying the existing sprinkler system from "extra hazard", as required by former Arsenal functions, to "light hazard" required by current "museum" use. This consideration was rejected because it would be unwise to take less fire protection than is existing. In addition, the cost of system modifications required would be more than the potential cost saving for reduced service size.

4.1 DESIGN CRITERIA

a) Arsenal domestic water requirements, based on proposed fixtures indicated in the Building Systems Analysis and Recommendations report dated March 6, 1979, are as follows:

14 water closets
6 urinals
12 lavatories
6 water cooler
4 janitors sinks

238 fixture units or
98 G.P.M. (Hunter supply-demand curve)

b) Commanding Officer's House domestic water requirements, based on existing fixtures, are:

7 tank type water closets
7 lavatories
4 tubs
1 shower
1 sink

65 fixture units or
33 G.P.M. (Hunter supply-demand curve)

c) The existing Arsenal sprinkler service is an 8" main supplying 3 dry sprinkler zones, covering a total area of 65,000 sq. ft. (4 floors plus attic).

4.2 SUMMARY OF OPTIONS

A. Fire and Domestic Supply from Byers St. at State St.

A new 8" combined fire and domestic service would originate from an existing 10" main under Byers St. at a point near the gatehouse. Piping would run in a trench beside the existing path and be tied into the existing water services just outside the Arsenal and the C.O.'s House (Fig. 15).

B. Fire and Domestic Supply from Byers St. North of State St.

A new 8" combined fire and domestic service would originate from the existing 10" main under Byers St. at a point about 320 feet north of State. Piping would run up the hillside and be tied into existing water services as for A. (Fig. 16).

C. Fire and Domestic Supply from State Street

A new 8" combined fire and domestic service would originate from an existing 20" main in State St. The piping trench would follow the route of the existing water main, and be tied into existing water services as for A (Fig. 17).

D. Second Fire and Domestic Supply from Pearl Street

In addition to any of the options above, a second (backup) 8" water service would originate from an existing 10" main in Pearl Street. The two supplies would be interconnected, before connecting with the existing services at a point outside the Arsenal and C.O.'s House (Fig. 18).

E. Domestic Only from Byers Street

A new 4" domestic service only would be provided. Any of the routes described in A, B, or C, could be chosen, although the City of Springfield DPW would prefer to work off Byers St. to avoid disrupting traffic on State. Fire protection service would remain connected to the college loop.

4.3 COST ESTIMATES

Costs below include street connection and meter, piping and trenching, and connection to the existing pipes at buildings 1 and 13. They also include overhead (10%), profit (10%) and escalation (15%). (See also App. G.)

Option A	$31,841
B	$24,815
C	$27,337
D add	$35,655 to A, B, or C
E	$14,365

4.4 DISCUSSION AND RECOMMENDATIONS

In the event of perimeter disruption, the alternate supply D would continue to provide fire protection. A telephone conversation with Awkwright Boston Insurance (a Fidelity Mutual Agent) elicited the information that two water services are required for insurance over $40 million. We would note that even this redundant service would not provide protection as reliable as the existing college loop system.

Therefore, we recommend retaining the existing sprinkler service connection to the college loop and installing a single domestic service, option E.

If the existing sprinkler service cannot be retained, we recommend a two-way supply system, Option D. The choice among routing options A, B, and C, may be tied to the choice of routing for the electric cable duct bank. If option A is combined with electric scheme 1a or 3a, B with 1 or 3, or C with 2, a single trench could contain both services.

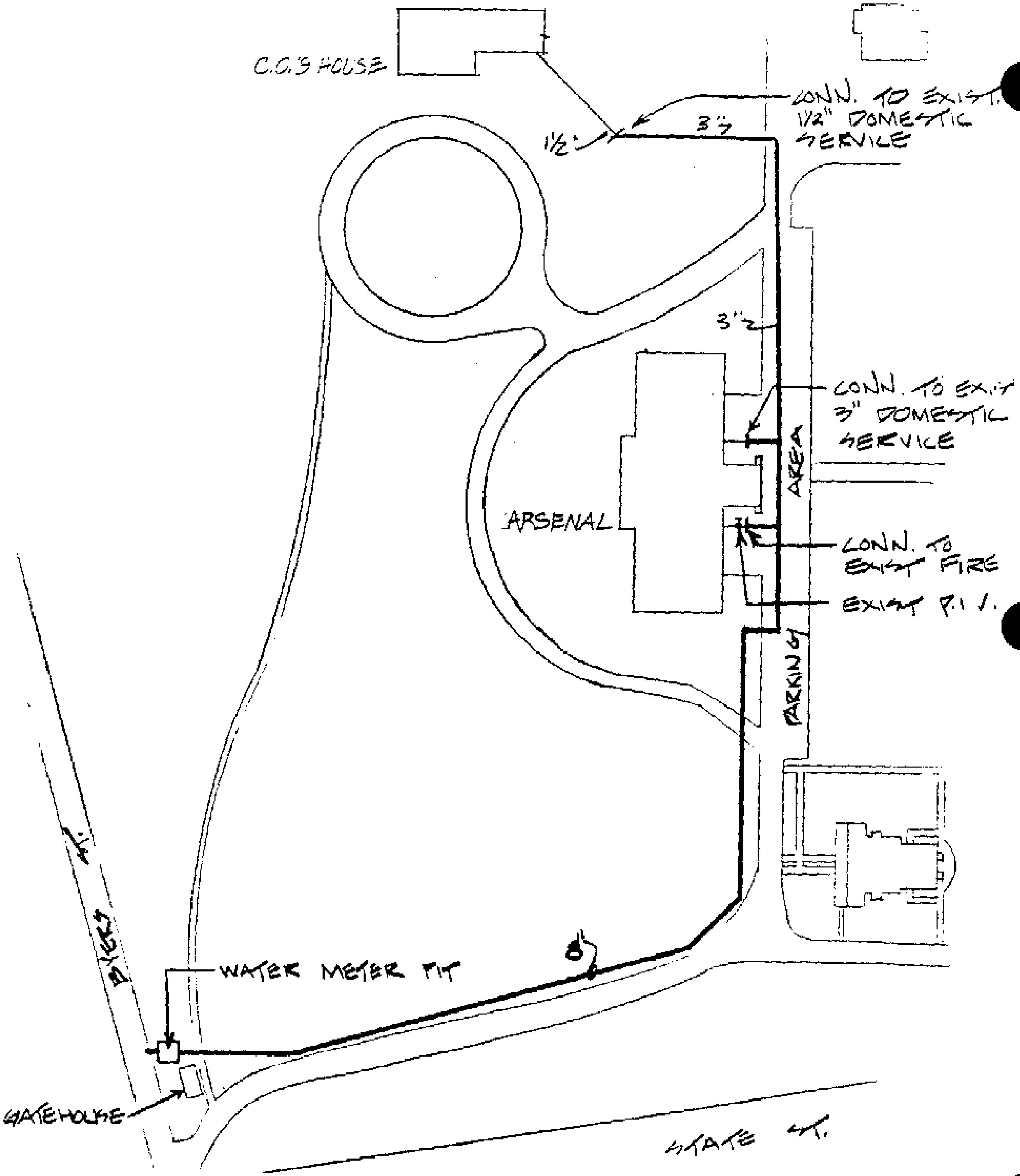


FIGURE 15: WATER SUPPLY OPTION A

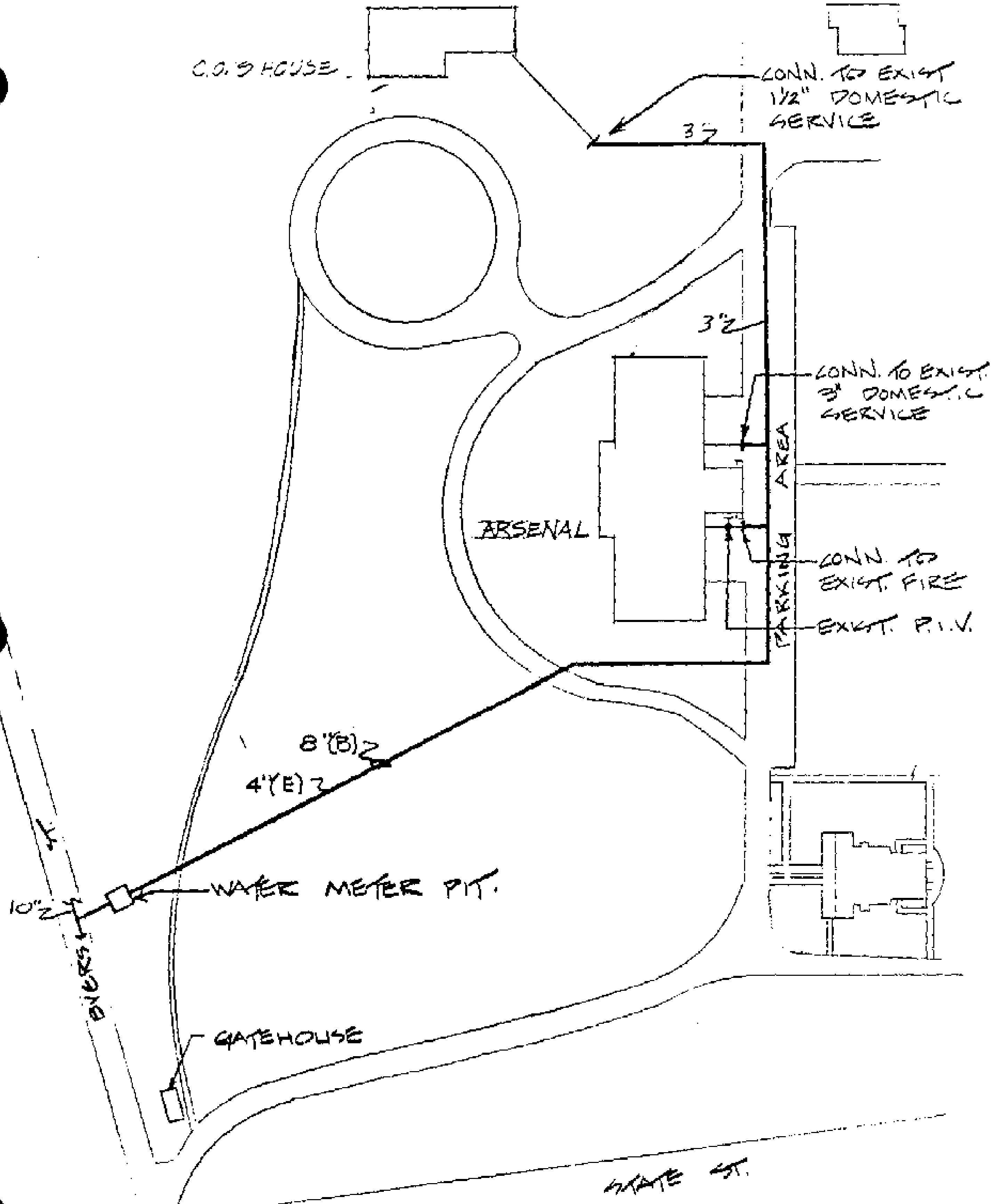


FIGURE 16: WATER SUPPLY OPTION B

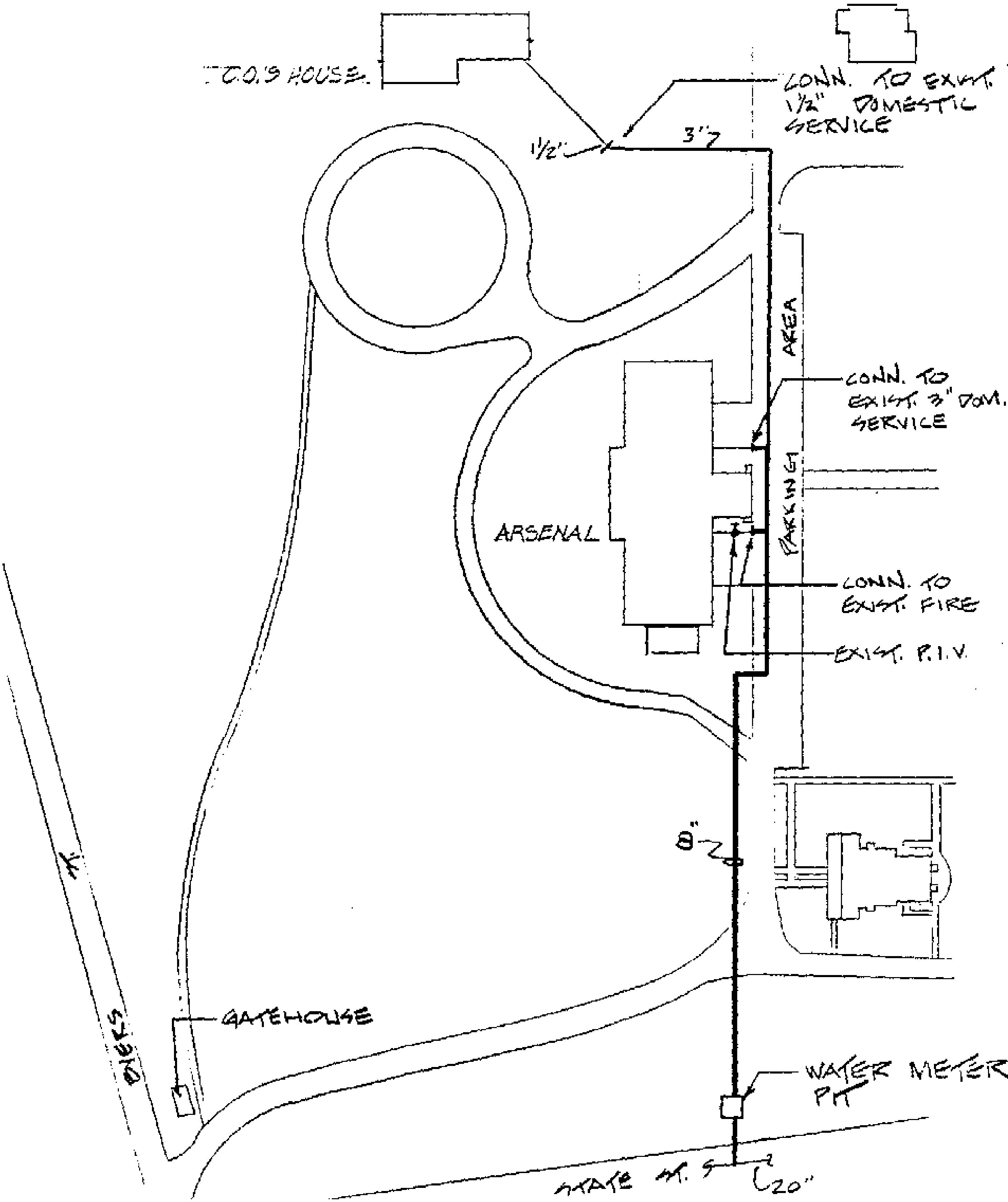


FIGURE 17: WATER SUPPLY OPTION C

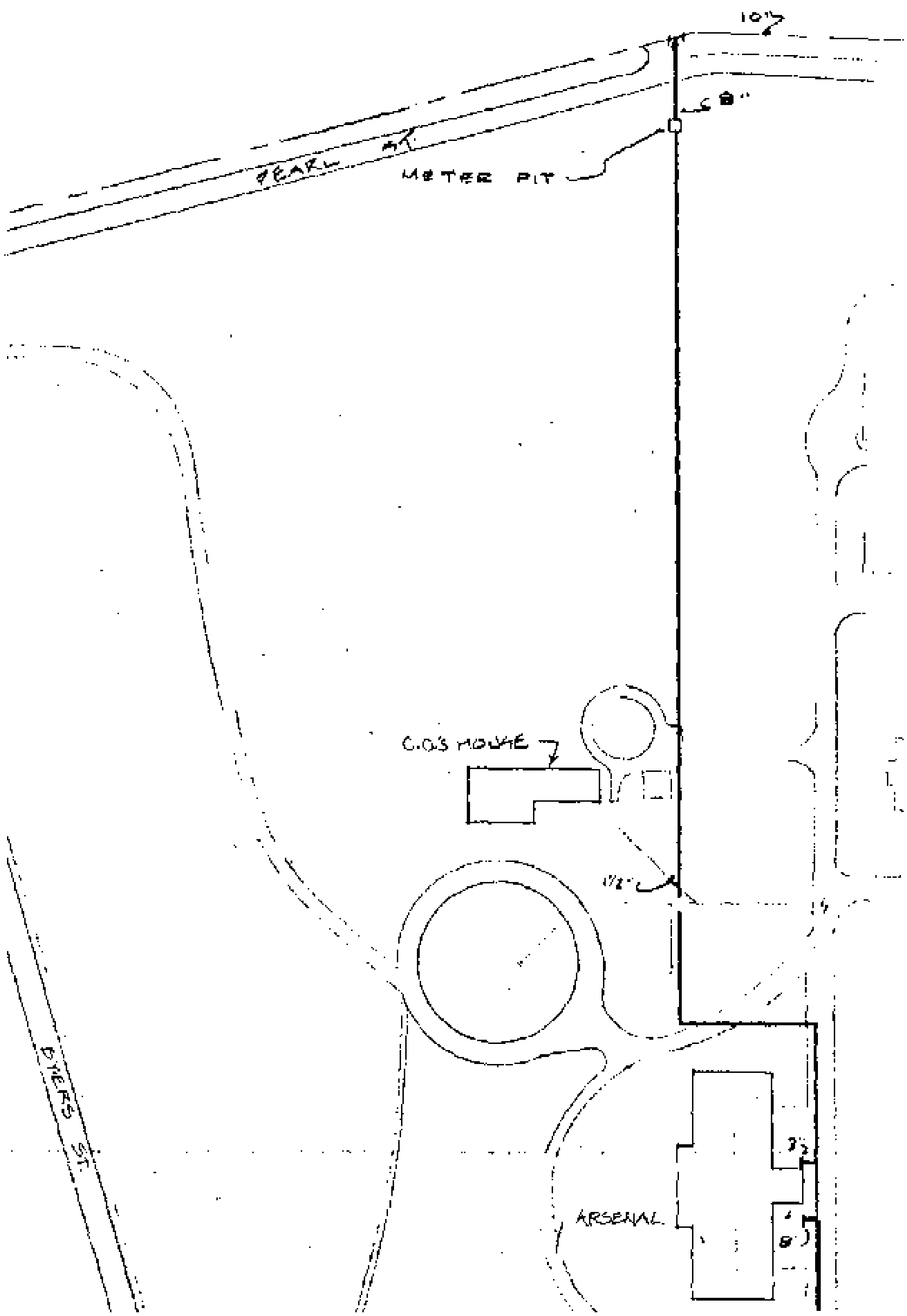
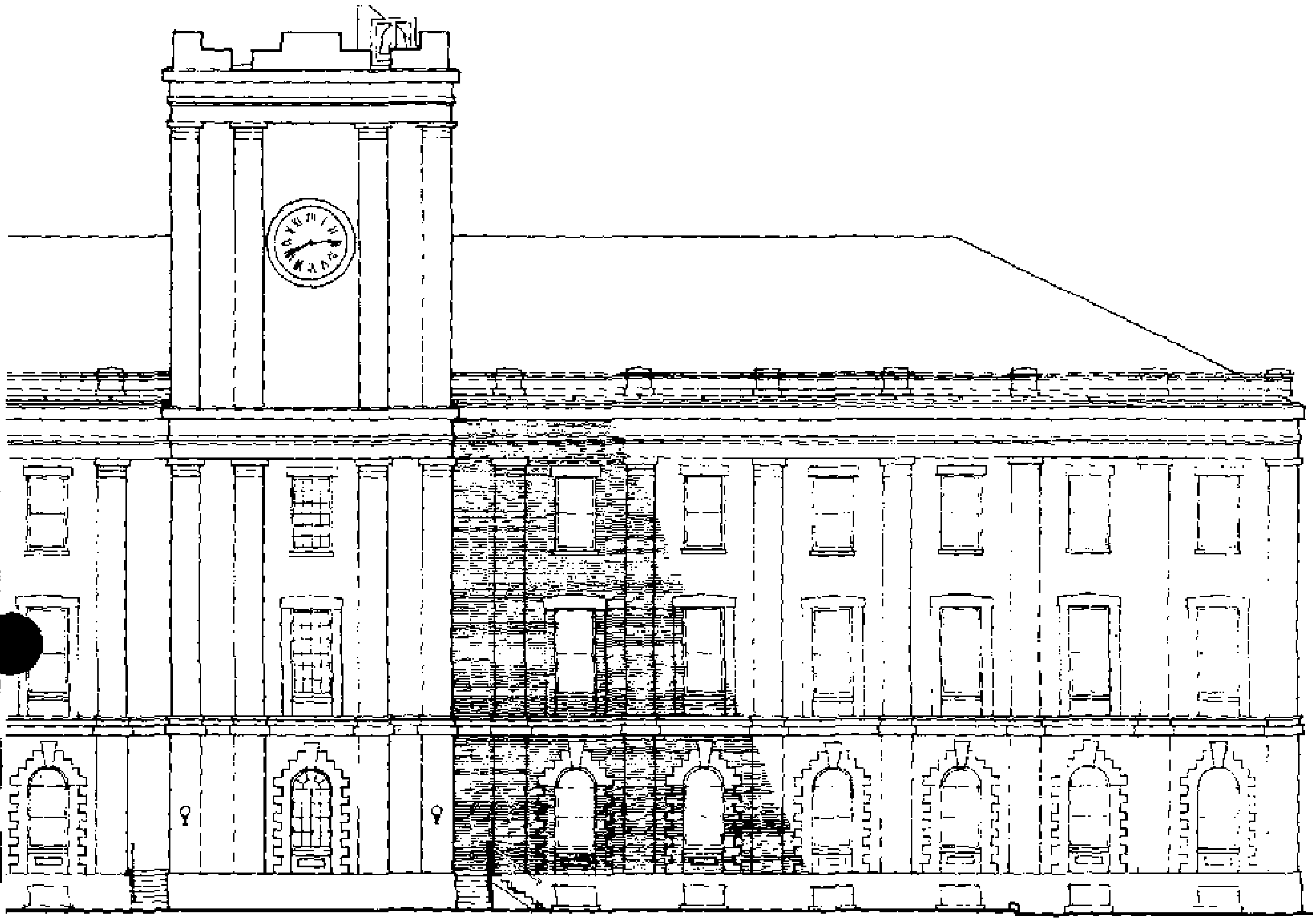


FIGURE 18: WATER SUPPLY OPTION D, SECOND SUPPLY.

APPENDIX B-3

MATERIAL CONDITION SURVEY AND RECOMMENDATIONS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE



MATERIAL CONDITION SURVEY AND RECOMMENDATIONS

prepared for the
National Park Service
by
Stull Associates, Inc. and
Building Conservation Technology, Inc.

MATERIAL CONDITION SURVEY AND RECOMMENDATIONS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

Main Arsenal
Commanding Officer's House
Garage
Gatehouse

prepared for the
National Park Service
Basic Agreement No. CX-2000-8-0044
Work Directive No. 8-0044-78-02

March 6, 1979

by Stull Associates, Inc.
431 Marlborough Street, Boston, Massachusetts 02115

and
Building Conservation Technology, Inc.
1010 Vermont Avenue, N.W., Suite 1117, Washington, D.C. 20005

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C. RECOMMENDATIONS

The Main Arsenal is in fair physical condition but immediate action is needed to prevent further damage to the exterior and interior building fabric. The faulty roof and ground drainage systems have caused most of the material deterioration: loss of mortar joints, spalling of stone and brick and rotting of wood trim.

1. ROOF

The slate roof has not acted as a watertight skin, as evidenced by water stains on the interior roof structure. Fifteen percent of the slate have cracked, chipped or have been tarred and metal plates have been inserted between many of the slate to minimize leaking. These plates have corroded and stained the adjacent roof materials. The copper ridge caps have open joints, the wood parapet/snowrail has deteriorated badly and the tower roof has been damaged by poor drainage.

a. The slate roof appears to be in good condition and there is no apparent reason for the amount of leakage which occurred before the metal plates were added. Two possibilities are that roof paper was not attached to the wood sheathing when the slate were replaced in the 1930's, or that the nail holes in the slates were not properly covered. The ultimate goal should be to remove the slate, replace all rotted sheathing and reroof, using as many of the existing slate as possible. However, until this solution is economically feasible, the following remedial repairs should be made and will provide protection from moisture damage. Replace the approximately 2400 square feet of chipped or broken slate with new slate matching the existing in size, color and exposure, and replace the corroded metal sheets between the slate with copper. The repair of ridge caps and the roof drainage system will also help reduce leakage. duce leakage.

b. Replace the approximately 80 linear feet of buckled and bent copper ridge cap with new copper formed to match the existing. Close and seal all open joints and replace all missing copper nails with new. It may be possible to reuse sections of the damaged ridge cap depending upon the remaining thickness of sound copper and its brittleness.

c. Remove the existing 416 linear feet (1,050 square feet) of the wood snowrail/parapet from the eaveline when the present gutters are replaced. Replace those sections which have rotted (including the 84 linear feet that are missing) with new pressure-treated, decay-resistant wood, duplicating the original size and design. Remove loose dirt and paint from intact sections and treat with a preservative, such as pentachorophenol in oil. The entire snowrail should be painted with 3 to 4 coats of an alkyd based paint. A preferable solution in terms of long range costs and ease of maintenance would be to cast the snowrail in either polyurethane or fiberglass, either of which can be painted or pigmented during casting.

d. Remove the asphalt-coated copper tower roofing (approximately 675 square feet) and replace with new roofing materials. Choice of materials and type of construction will depend on the type of use the tower is to receive, i.e., visitors look-out, guard station, etc.

e. Remove the existing wood and wire mesh safety railing and replace with a railing more sympathetic to the architectural design of the building. No wood framing or rails should be attached to the sandstone parapet as in the existing safety rail as this increases moisture absorption of the stone. A possible solution would be to construct a railing set back from the stone parapet which would not be visible from the ground.

f. Wirebrush or sandblast the steel framework (approximately 4 linear feet) supporting the tower bell and treat with a rust inhibitor. Replace the wood framing members (4 linear feet) with new pressure-treated, decay resistant wood and paint both wood and steel with three coats of alkyd paint.

2. ROOF AND GROUND DRAINAGE SYSTEMS

The valleys, gutters, down-conductors and sub-surface drains are not in working order due to clogging and open seams. As a result, water has not drained off and away from the building properly and has caused deterioration of masonry and wood surfaces near these malfunctioning elements, as well as damage to interior plaster finishes. The concrete paving and basement window curbs have increased the moisture problems at the basement of the building (see Section 3 for discussion of masonry deterioration).

a. Replace all of the 545 linear feet of built-in copper gutters and eave flashing (including those on the tower) with new 16 pound copper sheeting, in size and design matching the original. Wire screens should be added over the gutters to aid in keeping them free of debris. The 150 linear feet of copper valleys, now coated with tar, should also be replaced. It is not advisable to retain the existing gutters and valleys and continue to patch open joints with tar as this coating deteriorates quickly and will result in future leakage and maintenance problems. Investigate the ends of the roof trusses at the eaves to determine the extent of moisture damage.

b. Replace all eight down conductors (approximately 52 linear feet each, 416 linear feet total) with new copper conductors. If these elements continue to back up after the sub-surface drains are repaired or replaced, consideration should be given to enlarging the size of the new elements to 8 inches in diameter, to more efficiently drain the roof and to avoid back-ups and overflows in heavy storms. The openings in the stone cornice through which the conductors pass would have to be enlarged, as well as the connections to the ground drainage system. An alternative solution would be to increase the number of down conductors. The maximum suggested spacing between such elements is 50 feet; the spacing on the Arsenal is 68 feet on the side elevations and 85 feet on the front. Installation of additional down conductors would require careful planning so as not to visually disturb the architectural composition of the Arsenal walls.

c. Clean out all existing sub-surface drains to ensure maximum drainage away from the building foundation. All down conductors should feed directly into these drains and their connections should be watertight. If the existing sub-surface drains do not adequately and expeditiously drain away from the building, a new ground drainage system should be considered, i.e., new field drains emptying 20 to 30 feet from the foundations.

d. Remove the approximately 3200 square feet of concrete paving which butts up against the front of the building and the 2600 cubic feet of loading dock, the concrete stairs and the handicap access ramp. Replace the concrete walks with brick, granite or similar material depending upon evidence of historical paving found under the present covering. New paving material should be laid over a gravel base and in sand to promote rapid drainage of water away from the building masonry. Study new methods of handicap access. Reconstruct the lower end of the tower stairs (see Millwork).

e. Remove the 37 concrete curbs and 15 aluminum shields on the basement windows. Replace with a new concrete or metal curb designed to direct water away from the window well. Lower the ground level within the well to at least 12 inches below sill level and fill with 6 to 8 inches of gravel fill to promote proper and speedy drainage. Institute a regular maintenance schedule to keep wells free of leaves and debris.

3. MASONRY

Damage to brick, stone and mortar has been caused mainly by excessive water in contact with these surfaces due to the faulty roof and ground drainage systems. Approximately 30% of the mortar joints have deteriorated, 40% of the sandstone watertable shows spalling, and the remainder of the stonework has been stained by moisture and pollutants. Pitting of the bricks and disfiguration of the mortar joints was caused by the sandblasting of the building in 1937 to remove the paint build-up. The brick and stone, however, are generally in good condition.

a. Repoint the entire stone cornice (approximately 1200 square feet), the brick cornice belt below (approximately 2400 square feet), the brick masonry surrounding the down conductors (approximately 1200 square feet), the first ten courses of brick above the tower watertable (approximately 246 square feet), and the entire stone watertable (approximimtely 1800 square feet). Appropriate mortar recipes for repointing have been determined for both brick and stone and are included in a separate volume, Paint and Mortar Analysis. Since spot repointing of the brick could result in a patchy surface appearance, the new mortar should be applied to a test area to ensure that the dried mortar color and joint configuration match the existing. (Repointing will not be as noticeable on the stone because of the colored mortar.)

The face of the joint should be set back approximately 1/8 inch from the face of the brick to imitate the sandblasted joints. Stippling of the joints will provide a weathered appearance. If satisfactory results cannot be achieved with these means, it will be necessary to repoint the entire building.

b. Remove efflorescence from brick and stone surfaces. The smaller patches of salt will probably wash off with the action of the wind and rainwater. The larger areas, for example, at the base of the tower, should be removed when the wall is dry by brushing with a stiff fiber brush. Road surfaces and pavement in the vicinity of the Arsenal should not be salted during the winter months as this has increased the efflorescence. Snow and ice in this area should be removed by hand.

c. Slow the deterioration of the sandstone watertable by reducing the amount of water with which it comes in contact, i.e., correct roof and ground drainage problems and remove concrete paving. Consolidation of the stone in this case or application of waterproof coating would not be successful. A water repellant coating such as Chem-Trete manufactured by Dresser Industries may be of some use. The stone, however, is in good condition with spalling and deterioration occurring only on the surface 1/4 to 1/2 inch. Simple repointing of the stone joints and correction of the drainage problems will significantly reduce deterioration.

d. As with the sandstone, spalling and deterioration of the brick has occurred at the surface 1/4 to 1/2 inch. Removal of the cause of the deterioration, as with the stonework, will greatly inhibit future deterioration. If the deteriorated masonry is, at present, considered unsightly or, in the future, when the depth of deterioration reaches 2 inches, the brick unit should be removed and either replaced with a new matching brick or simply reversed and reset in its original position.

e. Painting of the masonry as a means of conservation is unnecessary. The brick masonry is in good condition and, although pitted, has experienced none of the deterioration problems normally associated with sandblasting. Painting of the masonry will only create additional maintenance (repainting required every 3 to 5 years with periodic removal of build-up) and should be undertaken only if necessary to accurately interpret the history of the structure.

4. MILLWORK

All of the 130 wood windows are in poor condition due to lack of maintenance and exposure to the weather. Paint has peeled badly, especially on sills and lower rails and wood in these areas has checked and rotted. The majority of the glazing putty and caulking around the frames has deteriorated, allowing rainwater to leak into the interior here, as well as through the rotted sills. As a result, interior finishes and floors have been water-stained. Eighty percent of the masonry sills and wall surfaces directly below the windows have been stained white from the chalking of the paint on the frames.

a. Replace all of the sills and lower rails which have rotted or weathered beyond repair (approximately 80 percent or 104) with new decay-resistant pressure-treated wood, matching the existing (in size, design and profile). Although it may be cost prohibitive, the damaged sills and rail could be repaired/consolidated using epoxy resins thereby eliminating removal of what may be original fabric.

b. Restore those elements of the windows not needing replacement, i.e., all upper rails, sash, muntins, stiles and frames. Remove loose dirt and paint and treat wood with a preservative such as pentachorophenol in oil. Reputty glazing on all windows with a flexible polyurethane sealant and recaulk all window frames. Paint with a primer and 2 to 3 coats of alkyd-based non-chalking exterior paint.

c. Restore the circular window in the southwest wall of the tower, following the procedures outlined above in b. All of the wood muntins should be replaced but the glass should be reused if possible. The damaged interior masonry window reveal and adjacent wall should be brushed with a stiff fiber brush and a new coating of whitewash applied.

d. Reconstruct the first floor window sash in the southeast end of the pavillion, which has been removed and blocked off.

e. Reconstruct the lower portion of the tower doors after the concrete loading dock and pavement have been removed. The lower section should be patterned after the remaining upper section. Reuse all existing wood and hardware. The southeast door should be removed from the overhead track and rehung to match the north exit door.

f. Reconstruct the lower end of the tower stair, after the concrete dock has been removed and the southeast door rehung. A conjectural drawing in the Historic Structures Report shows the original configuration, however, this should be verified with any historical evidence found after removal of the dock. Stairs to the first floor door of the Arsenal must also be reconstructed based on evidence found under the concrete. Remove the recent coat of plaster that now covers the wood architrave framing the door and paint to match the wood frames around the tower doors.

5. CLOCKS AND FIRE ESCAPES

The three wood-faced clocks on the Arsenal tower are in fair condition: paint is peeling from the surfaces, wood has begun to warp, but the majority of the numerals are intact. The clock on the pediment of the southwest elevation is in poor condition. Deterioration of this face has been aggravated by the southern exposure and the excessive amount of moisture draining down the face of the pediment through open joints in the raking cornice. All clocks need immediate attention if the original fabric is to be retained and restored.

The two fire escapes on the northwest and southeast elevations are not painted and have corroded. The anchoring to the brick has not caused any damage, although the masonry has been stained from the corrosion carried by the rainwater.

a. Retain the services of the original manufacturer of the clock to examine mechanism and faces and to determine exact extent of repair necessary.

b. Sandblast, prime and paint the fire escapes unless code requirements are such that they can be completely removed.

6. INTERIOR

Most of the damage to the interior surfaces has occurred in the basement and the third floor where moisture entering through open mortar joints, rotten sills, and rising damp action has deteriorated much of the wall finishes. Moisture has also damaged the plaster beneath the tin ceilings. The expansion of the tin panels has caused buckling at the ceiling perimeters. Wood sills, wainscoting, and floors on the third floor have also been stained. The top two floors of the tower have experienced similar deterioration. The first and second floors, in comparsion, are in foor condition.

a. After correction of the ground drainage problem, clean all basement walls of efflorescence and loose whitewash with a stiff bristle brush, repoint where necessary and apply a new coating of whitewash.

b. Remove the perimeter panels of the pressed metal ceilings on all floors, approximately 1600 square feet total, to determine the extent of moisture damage to the ceiling plaster and lath beneath. Plaster which has fallen onto the metal panels should be removed and rotted lath should be replaced. Deterioration under surrounding panels should be investigated and similar repairs made where necessary. Before reinstalling the perimeter panels, it would be advisable to trim approximately 1/4 inch off the outside edge to allow for the expansion of the metal and to minimize buckling problems in the future.

c. Repair all deteriorated wall plaster and lath after the roof drainage system has been replaced and the masonry has been repointed. The majority of damage has occurred on the upper levels of the tower and on the third floor (approximately 4500 square feet) but plaster wall surfaces on all floors should be sounded and repaired where necessary.

d. If it is determined by the Arsenal Museum curators that protection from ultra-violet rays is needed for the gun collection, some treatment of the windows will be necessary. There are several alternatives, all of which will have some visual effect on the exterior of the building. Whitewash may have been used for this purpose since vestiges of this coating remain on the glass. However, it is not certain whether this was an original treatment. Whitewash could be reapplied, however, there would be several disadvantages. Natural light into the building would be significantly reduced and views to the exterior would be impossible. In addition, if condensation occurs on the glass, the whitewash coating will deteriorate and have to be reapplied. Another solution would be to use window shades. These could be pulled down only when needed, i.e., late afternoon on the southwest elevation, and not block out natural light and views during the other times of the day when ultra-violet was not a problem. The only other alternative would be to apply a sun control film, such as Scotchtint, to the double glazing to be added to the building. Films such as these reduce 95 percent of ultra-violet light while admitting visible light and, since the coatings are transparent, they do not visually interfere with views to the exterior. The lightest tint available in these films is light grey or smoke. A sample of this material might be obtained and applied to a test window to determine the effect of color and reflectivity on the exterior appearance of the building.

7. RECOMMENDATIONS FOR FABRIC REMOVAL

The following is a summary of the building elements which should be removed from the Arsenal due to material deterioration and/or lack of historic integrity. Refer to the preceding sections (1-6) for descriptions.

Remove:

<u>Exterior:</u>

a. The 80 linear feet of buckled copper ridge cap and replace as described in Section 1b.

b. The entire 416 linear feet of existing snowrail and repair/replace as described in Section 1c.

c. The asphalt-coated tower roofing and the wood and wire mesh safety fence and replace as described in Sections 1d and 1e.

d. All copper gutters, valleys, eave flashing and down conductors and replace as described in Sections 1a and 1b.

e. The concrete paving abutting the front elevation of the Arsenal, the concrete loading dock in the base of the tower and the stairs and replace as described in Section 1d.

f. The concrete curbs and aluminum shields on the basement windows and replace as described in Section 1e.

Interior:

g. The perimeter panels of the pressed metal ceilings on all floors; replace damaged plaster and edges of panels as described in Section 6b.

h. The recent coat of plaster applied over the wood architrave of the tower door to the first floor of the Arsenal. Restore to match the existing frame on the north tower door.

8. RECOMMENDATIONS FOR FURTHER STUDY

Exterior:

a. Determine the exact cause of past slate roof leakage and correct accordingly. Investigate the ends of the roof trusses at the attic level for rot when these repairs are made.

b. Study design alternatives for a new safety rail on the tower roof, as well as type of new roofing materials. Both of these will depend in part on the future use of the tower roof.

c. Observe the performance of the roof drainage system after the subsurface drains have been cleaned. If these elements continue to drain improperly and rising damp action continues in the watertable, study alternatives for adding additional or larger down conductors and/or a new sub-surface drainage system.

d. Determine new paving material for the Main Arsenal approach. Design lower end of tower stairs and stairs to the first floor based on fabric found after removal of the concrete loading dock.

e. Determine the most efficient and visually undisturbing method for the replacement of the concrete curbs around the basement windows.

f. Conduct a repointing test on an unobtrusive portion of the brickwork to determine the best method for applying the mortar and for tooling the joint configuration so that surface patchiness can be minimized.

g. Retain the services of the original clock manufacturer to examine clock faces and mechanism to determine exact extent and methods of repair necessary.

h. Determine the most efficient and visually undisturbing method for providing handicapped access to the building.

C. RECOMMENDATIONS

The Commanding Officer's House is in fair condition and has experienced deterioration problems similar to those of the Main Arsenal. Faulty roof and ground drainage systems, as well as a leaking roof, have caused most of the damage and thus are the first priority for repair work. Correction of the deteriorated masonry, mortar joints and millwork should follow.

1. ROOF AND ROOF ELEMENTS

The slate roof has not acted as a watertight skin in the past as evidenced by the damaged plaster surfaces (approximately 90 percent) and areas of exposed lath (approximately 100 square feet) in the attic. Much of the wood sheathing has probably been damaged by moisture. The floor boards, grained skylight frames and baseboards have also been water stained. Approximately 10 percent of the roof slate have been replaced with slate which does not match the original in color. About 20 percent are chipped, cracked or loose and copper sheets have been inserted between many to lessen the leakage. Open joints in the copper ridge cap have allowed additional moisture to enter the attic. The decorative cast iron snowrail at the eave line has suffered from lack of maintenance; 70 percent of the paint has peeled off, exposed areas have corroded, and 20 of the fleur-de-lis are missing. The three porch roofs are in fair condition; flashing connections on the porch roofs have opened up and the roofing has deteriorated in several areas.

a. Remove all of the slate roofing, approximately 3,785 square feet and replace all rotted wood sheathing, roof rafters and lath. Replaster all the attic wall surfaces after roof repairs have been made, and insulation (as specified by the mechanical engineers) has been inserted. Reuse as many of the original slate as possible; replacements should match the existing in size, color and exposure. A less costly alternative would be to remove the deteriorated lath and plaster from the attic surfaces and inspect the roof sheathing for rot from below. In this way, the total slate removal could be avoided--only those areas with rotted sheathing need be removed. However, if it is determined from this type of investigation that the majority of the sheathing has rotted, it will be necessary to follow the first alternative.

b. Remove the copper ridge cap before the roof is repaired. Reshape the approximatly 220 linear feet which have buckled or have been dented, where possible. Reuse will depend upon brittleness of copper and remaining thickness. Reattach caps after completion of roof repair and fasten securely with copper nails.

c. Remove the 300 linear feet of the cast iron snowrail. Remove loose paint and rust from the surfaces by wire brushing or sandblasting with a fine grit, low pressure process. Replace the horizontal rails that have been mended with tubing. Recast the missing fleur-de-lis and weld to the rail. Prime all surfaces with a rust inhibitor and paint with three coats of an alkyd based exterior enamel.

d. Repair the approximately 65 square feet of copper roof sheathing on the cast iron porch on the southeast and southwest elevations which has been damaged by water draining improperly off the main roof.

e. Replace the roll roofing on the wing cast iron porch, totalling approximately 280 square feet, with a flat seam copper roof, matching that on the main cast iron porch.

f. Remove the deteriorated metal roof on the cupola and determine if the original roofing or evidence of it is located beneath, and replace accordingly. Consideration should be given to redesigning the eave detail, so that rainwater drainage in the future will not continue to damage wood trim and masonry walls (see Section 2e). Replace the rotted sections of the wood cornice trim and restore the remainder, following procedures outlined in Section 4b.

2. ROOF DRAINAGE SYSTEMS

The copper gutters, down-conductors and flashing are generally not in working order due to open joints and seams. As a result, water has not drained off the building surfaces properly, causing deterioration of the masonry and damage to interior plaster and woodwork graining. Two down conductors are missing on the rear elevation; the two on the front elevation empty onto the porch roof causing staining and buckling of the copper roof sheets. The sub-surface drains are not draining water away from the building properly as evidenced by rising damp and efflorescence on the interior brick basement walls and on the exterior stone watertable. The cupola does not have a drainage system; water draining off the roof has corroded the metal roofing at the ridges, damaged wood trim and the masonry walls.

a. Replace all of the 550 linear feet (porches included) of copper gutters and gutter flashing with new 16 pound copper sheeting in size and design matching the original. Wire screens should be added over the gutters to keep them free from debris. Repoint the mortar joints in the stone cornice before installing the new gutters (see Section 3, Masonry).

b. Replace all six existing down conductors as well as those missing on the left end of the rear elevation and on the bay window, totalling approximately 260 linear feet. The nine down conductors on the porches, approximately 160 linear feet, should also be replaced. All down conductors should feed directly into the sub-surface drains and their connections should be watertight. The following revisions in the replacements should be made:

(1) Redesign the two down conductors on the southeast (front) elevation so that they do not drain onto the front porch roof. Conductors originally extended through the porch roof, down the first floor wall and through the porch floor as evident in the 1930's photograph and by paint particles remaining in the masonry. This method should be reinstigated as long as the down conductors can be directly connected to sub-surface drains below the porch.

(2) Refit the down conductor on the northeast elevation to properly drain the wing and porch roof without backing up and overflowing.

c. Replace all flashing around the cupola, skylights, dormers, chimneys and porch roofs, totalling approximately 450 linear feet.

d. Clean out all existing subsurface drains to ensure maximum drainage away from the building foundation. All down conductors should feed directly into these drains and their connections should be watertight. If the existing subsurface drains do not adequately and expeditiously drain water away from the buildings, a new ground drainage system should be considered, i.e., new field drains emptying 20 to 30 feet from the foundations.

e. To relieve the roof drainage problems of the cupola and to prevent future material deterioration, gutters and down conductors could be installed. However, a preferable solution would be to correctly detail the eaves when a new roof is installed. By flashing over the edges of the eave boards with copper, extending the roof covering further over the sheathing and installing a properly detailed drip molding, the problem can be alleviated without significantly altering the appearance of the cupola.

3. MASONRY

As in the Arsenal, the majority of damage to brick, stone and mortar has been caused by the excessive amounts of water in contact with these surfaces due to the faulty roof and ground drainage systems. Approximately 30 percent of the mortar joints have deteriorated, 20 percent of the sandstone watertable has experienced spalling and much of the stonework has been stained by moisture and pollutants. Pitting of the bricks and disfiguration of the mortar joints was caused by the sandblasting of the building in 1937 to remove the paint build-up. The brick, however, is generally in good condition.

a. Repoint the entire stone cornice (approximately 315 square feet), the brick cornice belt below (approximately 630 square feet), the brick masonry surrounding the down conductors (approximately 680 square feet), the 8 to 10 courses of brick above the porch flashing (approximately 370 square feet), the cupola (approximately 300 square feet) and the entire stone watertable, lintels and stairs (approximately 430 square feet). Appropriate mortar recipes for repointing have been determined for both brick and stone and are included in a separate volume, Paint and Mortar Analysis. Mortar should be applied to a test area to ensure that the applied mortar color and joint configuration match the original. Follow procedures outlined in Section 3a, Main Arsenal.

b. Remove efflorescence from brick and stone surfaces. The smaller patches of salt will probably wash off with the action of the wind and rainwater. The larger areas, for example on the northeast elevation, should be removed when the wall is dry by brushing with a stiff fiber brush.

c. Slow the deterioration of the sandstone watertable by reducing the amount of water with which it comes in contact, i.e., correct roof and ground drainage problems and remove concrete paving. Consolidation of the stone in this case or application of a waterproofing coating would not be successful. A water repellant coating such as Chem-Trete manufactured by Dresser Industries may be of some use. The stone, however, is in good condition with spalling and deteriorating occurring only on the surface ¼ to ½ inch. Simple repointing of the stone joints and correction of the drainage problems will significantly reduce deterioration.

d. As with the sandstone, spalling and deterioration of the brick has occurred at the surface ¼ to ½ inch. Removal of the cause of the deterioration, as with the stonework, will greatly inhibit future deterioration. Painting of the masonry as a means of conservation is unnecessary. The brick masonry is in good condition and, although pitted, has experienced none of the deterioration problems normally associated with sandblasting. Painting of the masonry will only create additional maintenance (repainting required every 3 to 5 years with periodic removal of build-up) and should be undertaken only if necessary to accurately interpret the history of the structure.

e. Repair the cracked and broken sandstone below the 14 shutter dogs on the watertable. The corroded dogs should be removed before additional deterioration occurs. These can be cleaned, painted with a rust inhibitor and replaced after the stone has been patched or a non-corrosive metal can be used for new dogs. The stone can be patched with either pointing mortar or epoxy mortar. Pointing mortar used for the watertable would be most desirable.

f. The sandstone stairs on the northeast porch should be removed and replaced with new stone, matching the original in size, design and color. An alternative would be to retain the existing stone steps and treat with a stone consolidator.

4. MILLWORK

The 60 wood windows on the Commanding Officer's House are in fair condition, those on the basement and second floors being the worst due to exposure and lack of maintenance. The wood porch on the northeast elevation has suffered from similar problems, but water draining down the columns has caused the rotting of the column/railing connections as well as warping. Floorboards beneath columns on the wing porch have rotted.

a. Replace all rotted wood frames, sash and sills on the 12 basement windows (approximately 90 percent) with new pressure-treated, decay resistant wood, in size, design and profile duplicating the existing. Recaulk all window frames and paint with a primer and three coats of alkyd-based, non-chalking exterior paint.

b. Restore the 15 first floor windows by removing loose dirt and paint by sanding and treating wood with a preservative such as pentachorophenol in oil. Replace glazing putty and caulking and repaint with a primer and three coats of alkyd-based, non-chalking exterior paint, color to be specified. Dormer trim should be treated similarly.

c. Replace all rotted sills and lower rails on the 19 second floor windows (approximately 80 percent) with new pressure-treated or decay resistant wood. Although it may be cost prohibitive, the damaged sills and rails could be repaired/consolidated using epoxy resins. Restore the remainder of the windows as in b, above.

d. Remove the aluminum storm windows and replace with wood storm sash.

e. Replace all rotted wood on the northeast porch: the bases of the four columns, floorboards running under and in the vicinity of the columns and the horizontal rails between the columns. Remove loose paint and dirt from the remainder of the porch structure and treat all surfaces with a preservative. Repaint with three coats of an alkyd-based, exterior non-chalking paint.

f. Replace rotted and warped floorboards and ceiling boards on the southeast elevation cast iron porches, approximately 500 square feet, with new pressure-treated wood. Repaint with three coats of an alkyd-based exterior non-chalking paint.

5. CAST IRON PORCHES

The cast iron porches on the southeast (front) and southwest elevations are in fair condition. Deterioration of flashing and improper roof drainage have caused most of the damage to materials (see Section 2 for description). The only other problems are excessive paint build-up on the cast iron elements and general cracking and chipping of the paint from surface corrosion of the iron.

a. Clean all of the cast iron on the porches by wire brushing or by sandblasting with a fine grit, low pressure process. Surfaces must be free of rust for new paint to successfully bond with and protect the metal. Since this process will remove most of the paint layers, all layers should be color coded to aid in future interpretation efforts. The cast iron should be treated with a rust inhibitor and painted with 3 to 4 coats of alkyd-based exterior paint.

6. INTERIOR

Deterioration to the interior of the Commanding Officer's House has occurred in the basement and in the attic. Moisture entering through open mortar joints in the masonry and through rotten sills has damaged whitewash and plaster finishes, interior mortar joints and flooring. Corroded pipes have caused additional damage.

a. After the ground drainage problems have been corrected, replace the rotted floorboards and sleepers in the basement, approximately 950 square feet, with new pressure-treated or decay-resistant wood.

b. Clean all basement walls of efflorescence and loose whitewash with a stiff bristle brush, after the ground drainage systems have been repaired. Corroded sanitary pipes should also be repaired or replaced at this time. Apply a new coating of whitewash.

c. Replace the iron lintel over the fireplace in Room B09 and repoint the dislodged masonry after the new lintel has been inserted.

d. Replaster the attic wall surfaces after repairs to the slate roof, wood sheathing and lath have been completed.

7. RECOMMENDATIONS FOR FABRIC REMOVAL

The following is a summary of the building elements which should be removed from the Commanding Officer's House due to material deterioration, lack of historic integrity or to enable further investigation of historic fabric. Refer to the preceeding sections (1-6) for descriptions.

Remove:

<u>Exterior</u>

a. The copper ridge cap and replace as described in Section 1b.

b. The 300 linear feet of cast iron snowrail and restore as described in Section 1c.

c. All copper gutters, eave flashing and down conductors (those on porches included) and replace as described in 2a and 2b.

d. All flashing around cupola, skylights, dormers, chimneys and porch roofs as described in 2c.

e. The roll roofing on the wing porch, southeast elevation, replace as in Section 1e.

f. The sandstone stairs on the northeast porch and replace/restore as described in Section 3f.

g. The present aluminum storm sash and replace as in Section 4d.

<u>Interior</u>

h. The recent jambs of the frame between Rooms 101 and 102 to determine if there are pockets for sliding doors in the walls, if the doors are still in place, or if there is evidence of sidelights or a similar element.

i. The recent jambs of the frame between Rooms 103 and 104 to determine if there are pockets for sliding doors and if the doors are still in place.

j. The present stairs in Room 209 to determine if there is physical evidence of the stair arrangement illustrated in this place in the 1876 plan.

8. RECOMMENDATIONS FOR FURTHER STUDY: COMMANDING OFFICER'S HOUSE

Exterior

a. Determine the exact cause of past slate roof leakage and correct accordingly.

b. Conduct a repointing test on the brick as described for the Main Arsenal.

c. Determine the most efficient and visually undisturbing method for providing handicapped access to the building.

Interior

d. Determine if any of the original gas light fixtures can be relocated and reinstalled after wiring for electricity. Explore the possibilities of obtaining fixtures similar to the original, as shown on the following pages. Check with the manufacturer to determine reproduction possibilities, if similar original fixtures cannot be found.

B. RECOMMENDATIONS

The Garage is in good physical condition and has not experienced any major material deterioration. Existing problems are the result of lack of maintenance and are easily correctable.

1. ROOF

a. Repair the open seams in the roll roofing with mastic.

2. ROOF DRAINAGE SYSTEM

a. Repair the seven open seams in the gutters, clean of corrosion and repaint. Replacement will probably be necessary within the next 5 to 10 years. Consideration should be given to replacing the galvanized gutters and downspouts with copper; although the initial cost is somewhat higher, future maintenance costs will be considerably less. A regular maintenance program should be initiated to keep gutters and downspouts free of debris.

b. Replace the missing down conductor on the southeast corner of the building. Install wire baskets in the gutters at the openings of the downspouts and install splash blocks at the base of each to direct water away from the base of the building.

c. Remove the wood and bricks which are stored along the rear and southwest walls to help eliminate moisture retention in the masonry.

3. MASONRY

The exterior brick is in good condition and, at this time, no repointing is required. The mortar, however, was analyzed to determine composition and proportions for use if pointing is needed in the future. Results of this analysis are included in a separate volume, Paint and Mortar Analysis.

4. MILLWORK

a. If the three windows, each approximately 2 1/2 by 4 feet in size are to remain closed for security reasons, the plywood coverings should be caulked around the edges to prevent moisture leakage to the window frame behind and to the interior.

b. Repaint the wood cornice and soffit after correcting the leaking gutters. Recaulk the Garage door openings and repaint the doors, after properly preparing the surfaces.

C. RECOMMENDATIONS

The Gatehouse is in fair condition, having suffered from roof and ground drainage problems, lack of maintenance, vandalism and an interior fire. The first repair priority is to correct the leaking roof and charred rafters, followed by repair of the roof and ground drainage, repointing of deteriorated mortar joints at the base of the building and repainting of the wall surfaces. The window sash should be replaced when the future use of the building is decided.

1. ROOF

The hipped slate roof has not functioned as a water-tight skin. Many of the ridge slates have loosened, approximately two dozen have fallen off, and water has leaked through to the wood roof sheathing and the interior. The wood bed molding, eaves and soffits have deteriorated due to improper detailing at the eaves.

a. Remove the 184 square feet of roof slate and replace the rotted wood sheathing, charred rafters and ceiling joists beneath with new pressure-treated decay-resistant wood. The entire bed mold and soffit (approximately 96 square feet) should also be replaced. Reuse of many of the slates as possible and replace missing slates with duplicates in size, color, and exposure. Detailing at eaves should be improved to prevent future rotting of sheathing. A slight extension of the slate or flashing over sheathing would be adequate.

b. Replace the 12 linear feet of chimney flashing with new copper step flashing.

2. ROOF AND GROUND DRAINAGE SYSTEM

The gatehouse has no gutters or downspouts nor is the detailing at the eaves correct. Roof water, therefore, is allowed to run over and seep into the roof sheathing, bed molding, and soffit boards causing rot conditions. The ground water drainage presents a more serious and difficult problem to solve. Ground water from the adjacent hill flows directly into the Gatehouse area, and is causing shifting of the ground contours at the base of the building. The ground level at the northeast and northwest elevations is at present approximately 9 to 12 inches above the original. Free water has been running down the hill in great enough quantities to shift the entire front southwest corner column 2 inches out of position.

a. To relieve the problem and prevent future deterioration, gutters and downspouts may be installed. A preferable solution, however, would be to correctly detail the eaves when a new roof is installed. By flashing over the edges of the eave boards with copper, extending the slate further over the sheathing and installing a properly detailed copper or wood drip molding, the problem can be alleviated without significantly altering the appearance of the building.

b. A retaining wall with subsurface drains should be constructed along the north side of the concrete walkway to control the water flow and soil erosion.

3. MASONRY

The majority of the exterior brick and mortar joints are intact, although paint is peeling from all the surfaces. Mortar has deteriorated due to the ground drainage problems and, in the chimney, due to the action of rainwater.

a. Repoint the entire chimney (50 square feet), the sandstone foundation sills (approximately 52 square feet) and the brick courses directly above this (approximately 78 square feet) on the northeast, northwest and southwest elevations. The appropriate mortar recipe has been determined by a laboratory analysis and is included in a separate volume, Paint and Mortar Analysis.

b. Remove loose layers of paint and dirt from the walls with a stiff fiber brush after all repairs to the roof and ground drainage systems have been made. Repaint with color to be specified.

4. MILLWORK

All of the four original window sash have been removed and the openings boarded over for security. The front door is still in place, but the glass areas have been boarded over and the door damaged by vandals. The east window frame of the northeast elevation has been damaged by fire.

a. If the building is planned to be actively used in the future, the northeast window frame and all four window sash should be replaced with new wood (2 windows at 2'-11" x 4'-10", 2 windows at 1'-8" x 2'-8"). The entry door should either be repaired or replaced. Since vandalism seems to be a problem, some security means will be necessary. Unbreakable glass such as Lexan, wire screen window covers or heavy window shutters are possible solutions; the unbreakable glass being the least offensive both visually and historically.

b. Paint all wood trim with exterior alkyd paint in the chosen color.

5. INTERIOR

The interior framing and finish have been damaged by fire concentrated at the northeast corner, the location of the original heating stove (now missing).

a. Replace the damaged portions of the ceiling plaster and lath.

b. Install a cast iron heating system.

c. Paint brick walls, plaster ceiling and wood trim with alkyd paint in chosen colors.

6. RECOMMENDATIONS FOR FABRIC REMOVAL

The following is a summary of the building elements which should be removed from the Gatehouse due to material deterioration. Refer to the preceding sections (1-5) for descriptions.

Exterior:

a. Remove the 184 square feet of roof slate and replace rotted sheathing and bed molding and charred rafters as described in Section 1a.

b. Remove the chimney flashing and replace, as described in Section 1b.

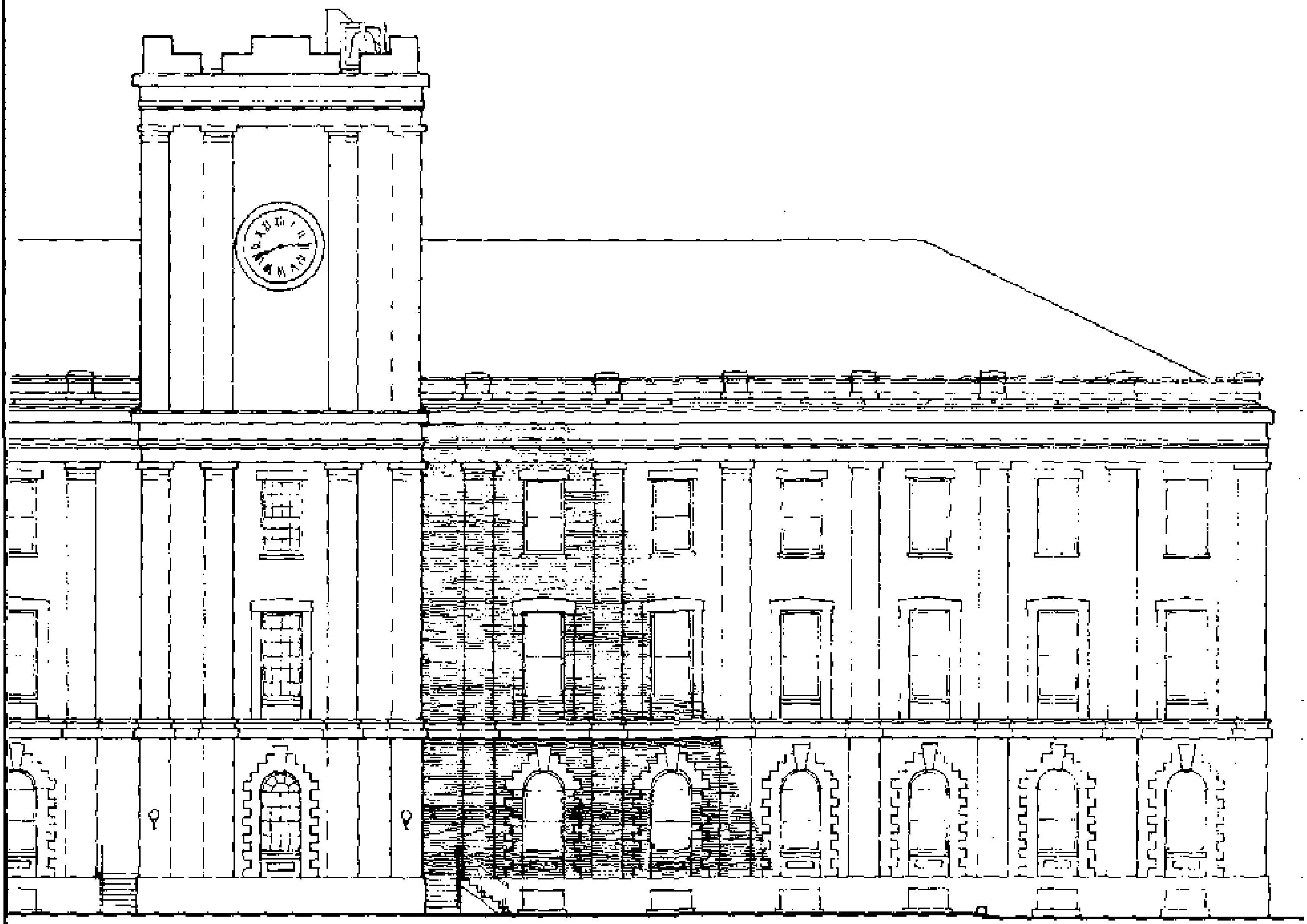
7. RECOMMENDATIONS FOR FURTHER STUDY

a. Study design alternatives for the construction of a retaining wall with subsurface drains along the north side of the concrete walkway.

APPENDIX B-4

PAINT AND MORTAR ANALYSIS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE



PAINT AND MORTAR ANALYSIS

prepared for the
National Park Service
by
Stull Associates, Inc. and
Building Conservation Technology, Inc.

PAINT AND MORTAR ANALYSIS

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

Main Arsenal
Commanding Officer's House
Garage
Gatehouse

prepared for the
National Park Service
Basic Agreement No. CX-2000-8-0044
Work Directive No. 8-0044-78-02

March 6, 1979

by
Stull Associates, Inc.
431 Marlborough Street, Boston, Massachusetts 02115

and
Building Conservation Technology, Inc.
1010 Vermont Avenue, N.W., Suite 1117, Washington,
D.C. 20005

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I. PAINT ANALYSIS: METHODOLOGY

An investigation of the exterior and interior painted surfaces was undertaken on the Main Arsenal, the Commanding Officer's House and the Gatehouse to determine the paint history of each building. Exterior finishes were studied on the Garage. The process involved cutting a small bevel through the entire paint layer sequence on each chosen surface. Each layer was then sufficiently scraped back and studied in-situ with a hand-held microscope to enable further identification and analysis of the paint. Numerous samples of each representative element were studied in this way to ensure that complete sequences were being identified. In addition, since a paint color can differ according to its location, exposure, composition and type of pigment and medium used, several samples on each element were compared. The accumulation of dirt, visible between the paint layers as a thin dark film, was a further aid in correctly identifying periods of application. A layer of paint which has been exposed for an extended period collects dirt and dust, which causes an imperfect bond with a subsequent paint layer. This dirt layer and the poor adhesion allows identification of each finish layer and provides a relative measurement of the length of time the layer was exposed. The use of glazes and varnish can be of further aid in identifying layers.

After exposing the paint layers in the sequence, each layer was then described using an appropriate color name, and recorded chronologically on the following charts. Horizontal slots on the charts have been assigned time periods in order to develop a general outline of the color schemes. Paint layers on the various architectural elements within each space applied at similar time periods are aligned on the charts. The horizontal recording of the paint layers on all of the charts will correspond so that color of all elements at approximately one time period can be determined. The recording of paint layers in this way can be of substantial use beyond color documentation. Those elements missing paint layers, having excessive paint layers or having inconsistent sequences can be readily observed from the charts. Relationships between various colors can also be recognized. These in turn can be an aid in identifying areas of paint removal, replacement, alterations and additions. Newer elements within each space have been identified with arrows pointing down to the first paint layers. Elements with early layers that have remained exposed to the present have been identified with arrows pointing up to these early layers.

Paint samples in this study have not been color coded since the exact time of restoration for the buildings has not been determined. When this decision is made, one paint layer per sample will be coded with the Munsell System of Color Notation. This system identifies the exact hue, chroma and value of the color by a code number, so that the correct color can be reproduced for repainting.

EXTERIOR

Finishes:

Masonry: The exterior walls were originally unpainted. In 1852, the bricks on both the Arsenal and the Commanding Officer's House were painted "ordnance colors" which was a medium orange-brown lime-based paint. Although there are no visible paint particles remaining on the brick, it is assumed that the Arsenal matched the Commanding Officer's House in its color scheme until the 1930's when both buildings were sandblasted.

Millwork: The wood window frames, sash, sills and tower doors were originally painted dark green as on the Commanding Officer's House. They were later painted brown when the masonry was painted medium orange-brown. Paint sequences beyond these layers are incomplete due to the abrasive effects of weathering, lack of maintenance and possible paint removal. However, careful study of pre-1900 photographs suggests that the wood snowrail was painted to match the stonework and window frames.

Alterations:

The lower portions of the tower doors were removed when the concrete loading dock and paving were added in the 1940's. A wood and wire mesh safety fence was added to the tower roof, as was a modern flagpole. Concrete curbs have been added around the basement windows, and aluminum eaves were added over those on the rear elevation.

INTERIOR

FIRST, SECOND AND THIRD FLOORS

Finishes:

Walls:	All plaster walls were also painted tan originally.
Millwork:	All wood window trim on all floors was originally painted tan and remained this color until the 20th century.
Cast Iron Columns:	The columns were painted to match the woodwork.

Alterations:

The existing pressed metal ceiling panels on the first and third floors were installed over the original plaster ceilings in approximately 1913. The second floor ceiling panels may have been added later, in 1920.

EXTERIOR

Finishes:

Masonry: The exterior masonry surfaces were originally unpainted. In 1852, the bricks on both the Commanding Officer's House and the Main Arsenal were painted "ordnance colors" which was a medium orange-brown lime based paint. The sandstone trim was not painted. A later coat of light orange-brown was applied over the first. The color scheme of the exterior was altered in approximately the 1880's when the brick was painted yellow. It remained this color until the 1930's when the exterior masonry was sandblasted to remove the paint layer build-up. The sandstone trim was painted white at some time between the 1900's and the 1930's and remained that way until the sandblasting. The raised brick pilasters on the corners of the walls were also painted white during that period.

Millwork: The original wood trim was painted dark green as evidenced by paint found in the grain of the wood. The millwork was painted a medium brown shortly thereafter in approximately 1852 when the brickwork was first painted medium orange-brown. It remained this color when the brick was painted light orange-brown and for a portion of the period when the walls were yellow. Dark green paint layers were located above the brown layers and were likely added in the first decade of the 20th century. Since the sandblasting in 1937, all millwork has been painted white.

Alterations:

The bay window was added to the northwest (rear) elevation before 1876 and was originally painted medium brown. The basement stair enclosure was added later, probably after 1876 but before the late 1880's. It was originally painted to match the light orange brown of the masonry; its window openings have recently been covered with plywood. The window from Room 105 was changed to a door at the turn of the century when the interior changes to that room were made. During the 1880's, the cast iron porch and snowrail were added. A list of contractors dated June 30, 1887 lists the "furnishing and putting up iron work for piazza on Commanding Officer's Quarters" by C. W. Walls and Company. These elements were originally painted brown to match the wood trim. The porch was later painted yellow-brown, and then dark green. It has remained white since the 1930's.

At the turn of the century, the original front door and sidelights were replaced with the present front door, and leaded glass fanlight and sidelights. In addition, the oval window on the front elevation of the wing was added and the cupola window sash were altered to one-over-one pane, wood sash with copper sills. During the 1920's, the wood porch on the northeast elevation was added. Many of the old paint layers were removed from woodwork and the painted masonry surfaces were sandblasted in the 1930's. All window sash are replacements.

COMMANDING OFFICER'S HOUSE

BASEMENT: Rooms B01-B10

Finishes:

Walls and ceiling: All walls and ceilings were originally white-washed. No traces of color were found on the samples examined.

Millwork: All doors, door frames and window frames were originally grained, however, only two doors retain the exposed graining layer.

Alterations: All window sash are replacements. Only two plaster ceilings are intact in the basement.

FIRST FLOOR: Room 101

Finishes:

Walls and ceiling: Walls were originally painted cream and cornice and dentils light brown. In the 1880's a multi-chromatic scheme was adopted, with rose walls, light orange-brown on the cornice and medium orange-brown in the dentils.

Millwork: All door frames and baseboards were originally painted cream. In the 1880's baseboards were painted rose, door frames and plinths were orange-brown, and recessed panels in the frames were a darker orange-brown.

Alterations: The original front door and sidelights were replaced around the turn of the century. The plaster ceiling is very recent. The inner reveal edge of the door frame leading from 101 to 102 is more recent than adjacent millwork. This reveal should be removed to determine if sidelights were once attached, or if sliding doors were once contained within.

FIRST FLOOR: Room 102

Finishes:

Walls and ceiling:	Walls were originally painted medium yellow-brown, with cornice and dentils a lighter yellow-brown. In the 1880's, walls were painted a medium orange-brown and the entablature of the pilasters framing the doorways was painted three shades of orange-brown.
Millwork:	Millwork was originally painted cream and in the 1880's was painted with two tones of orange-brown, as in Room 101, with lower baseboards dark orange-brown and upper baseboards lighter orange-brown.

Alterations: The original acanthus leaf motif in the ceiling centerpiece has been removed, probably when the light fixture was replaced. The ceiling has been replastered recently. The plywood wall closing off the stair hall (Room 107) is also new.

FIRST FLOOR: Room 103

Finishes:

Walls and ceiling: Walls and cornice were originally painted light yellow-brown and the ceiling cream. In the 1880's, walls and ceiling were light brown and the cornice alternated light and darker brown.

Millwork: All millwork was originally painted cream. In the 1880's, lower baseboards and doorway plinths were painted dark grey-brown; upper baseboards, door and window frames and shutters were painted light brown with darker brown accents on all the recessed panels.

Alterations: The picture mouldings were added slightly after the original construction. The mantle appears to have been added around the turn of the century. A piece of trim was added in the early 20th century to the doorway reveals between Rooms 103 and 104, which may have closed off the original sliding doors. The new reveals should be removed to determine if the doors are enclosed. All sash are new.

FIRST FLOOR: Room 104

Finishes:

Walls and ceiling:	Walls and cornices were originally light yellow-brown. Walls were later painted medium grey and in the 1880's the cornice was painted shades of light and medium brown, as in Room 103.
Millwork:	All millwork was originally cream. In the 1880's, millwork was painted shades of light and dark brown to match Room 103.

Alterations: The picture moulding was added some time after the building was completed and before 1880. All sash are new, as well as the bookcases. The ceiling and top moulding are also very recent alterations.

FIRST FLOOR: Room 105

Finishes:

Walls and ceiling:	Walls and ceiling were originally cream. In the 1880's the walls appeared to have been painted orange-brown.
Millwork:	Millwork was originally cream, and later grained.

Alterations:

After the 1880's, possibly at the same time the door from Room 106 was closed and the china closet in Room 106 was installed, a doorway was cut into the wall originally separating Room 105 from the main hall. At approximately the same time, the door in the north window opening was added.

FIRST FLOOR: Room 106

Finishes:

Walls and ceiling: Walls, cornices and ceilings were originally painted light yellow-brown. In the 1880's, walls appear to have been painted cream, while cornice, ceilings and plaster centerpiece were varied shades of orange-brown.

Millwork: All millwork was originally painted cream and subsequently grained. In the 1880's it was painted varying shades of orange-brown as in Rooms 103 and 104. The china closets and new mantlepiece were added in the early 1900's. Sashes, sills of the closets and the mantlepiece were stained and varnished. The closet panelling was painted cream.

Alterations: The bay window was added within 10-15 years of the building's completion. Missing layers in the middle of the sequence on the baseboard and lower surround under the bay window indicate that bookcases approximately 2 feet high may have been installed around the turn of the century. They were removed in the 1930's-1940's. The china cabinets and fireplace surrounds were added around the turn of the century at approximately the same time as the front door and sidelights in Room 101. The early paint layers on the door leading to Room 102 do not correspond to millwork on the rest of the room, but rather to that on Room 108. This and the evidences that the hinges have been changed indicate that the door was moved to its present location in the 20th century, probably at the time the doorway in 108 was closed off.

FIRST FLOOR: Room 107

Finishes:

Walls and ceiling:	As in the other parts of the hall, walls were originally medium yellow-brown and medium orange-brown in the 1880's.
Millwork:	Millwork was originally cream and later painted varying shades of orange-brown. Stair treads, balusters and newel posts were varnished.

Alterations: The door to 106 was closed off and a closet constructed in Room 107 around the door, probably at the same time that the china closets were installed. The top panels of the east door to Room 109 were removed and glass and muntins installed in the 1940's or later. Plywood fill in the doorway leading to Room 108 is very recent.

FIRST FLOOR: Room 108

Finishes:

Walls and ceiling:	Walls and cornice were originally painted light yellow-brown. The cornice was painted light red-brown soon afterwards. In the 1880's, walls were first painted light brown and then dark green, while the cornice was light olive.
Millwork:	Millwork was first painted cream and subsequently covered with dark graining. In the 1880's the color scheme was first dark olive on the lower baseboards and dark brown on upper baseboards, olive on door and window frames and plinths and darker olive on doors and recessed panels of the door and window frames. All trim was next painted green to match the dark green walls.

Alterations: The mantle and picture moulding appear to have been added around the turn of the century. The ceiling was replastered recently. All sash are new. Plywood fill in the doorway leading to Room 107 is very recent.

FIRST FLOOR: Room 109 & 109A

Finishes:

Walls and ceiling:	Walls were originally light yellow-brown and brown or dark brown in the 1870's/1880's.
Millwork:	Millwork was painted cream and then covered with light graining. In the 1870's/1880's, all elements were painted cream with the brown wall color and medium brown with the dark brown.

Alterations: The oval window in 190A was added around the turn of the century, probably when the wall between 109 and 109A was added. The east door and frame to 109A do not match the sequences on the woodwork in 109 and are not original to the space. The ceiling was replastered recently.

FIRST FLOOR: Room 110

Finishes:

Walls and ceiling:	The original walls were light yellow-brown and painted light brown in the 1870's/1880's.
Millwork:	Millwork was painted cream and then grained until the 1870's/1880's, when it was painted yellow-brown.

Alterations: The north wall was constructed around the 1880's. It appears that the west door to Room 106 was closed and wainscoting added about the same time. The upper panel of the door between Room 109 and 110 was removed and glass and muntins added around 1880-90. Cabinets were constructed on the west wall around the turn of the century. The ceiling was replastered in the 20th century.

FIRST FLOOR: Room 111

Finishes:

Walls and ceiling:	Walls were originally light brown and painted orange-pink around the 1880's.
Millwork:	Millwork was painted cream and then grained. It was light brown at the time the walls were orange-pink.

Alterations: Changes from the wall configuration shown in the 1876 plan and that found at present appear to have been made in the 1880's. The west wall and recessed portion of the north wall were original; recessed sections of the east wall were also original but treated as part of Room 112; the south wall and projecting portions of the north and east walls were added to enclose the room. The ceiling was also replastered at this time. Wainscoting and cabinets were added around the turn of the century. Sash is new.

FIRST FLOOR: Room 112

Finishes:

Walls and ceiling:	Walls were originally yellow-brown and painted medium to light grey-brown in the 1880's.
Millwork:	Millwork, including stair stringers and treads was originally grained until the 1880's, when it was painted grey-brown, with stair treads red-brown. The sidelights and north doorway were first varnished and later painted grey-brown. Stair balusters and railing have always been varnished.

Alterations: In the 1880's, the west wall was closed off and the stairway changed from a straight run to a dog-leg. Changes are apparent both from the differences in the paint sequence and splices on the baseboard and stair stringer. Sash and accoustical tile ceilings are recent additions.

FIRST FLOOR: Room 113

Finishes:

Walls and ceiling:	Walls were originally light brown and painted light blue-green in the 1880's.
Millwork:	Millwork was grained until the 1880's, when it was painted medium brown.

Alterations: Shelving was added in the 1870's or 1880's. The ceiling was recently refinished.

FIRST FLOOR: Rooms 115, 116 and 117

Finishes:

Walls and ceilings: Paint on walls in Room 115 was identical to that in Room 112. Walls in 116 were covered with wainscoting and recently-applied plaster. Ceilings in both rooms are covered with accoustical tiles. Brick walls and plaster ceilings in Room 117 were originally covered with whitewash. Walls were painted medium olive in the 1880's.

Millwork: All woodwork in these three rooms was grained through the 1880's.

Alterations: A wall and doorway was constructed between Rooms 117 and 118 around the turn of the century when an ice box (Room 117A) was added. Wainscoting was applied to Room 117 at this time. Sash is recent.

FIRST FLOOR: Room 118

Finishes:

Walls and ceiling:	Walls were originally whitewashed and painted medium olive in the 1880's.
Millwork:	Millwork was grained through the 1880's.

Alterations: The west door frame and baseboard were added in the 1950's and 1960's. The ceiling was replastered in the last decade.

FIRST FLOOR: Room 119 and 119A (114)

Finishes:

Walls and ceiling: Walls in Room 119 were originally painted light brown and ceilings cream, while walls in 119A (114) were whitewashed. In the 1880's, walls and ceiling in both rooms were medium olive.

Millwork: Millwork in both rooms were grained through the 1880's.

Alterations: The wainscoting, splash rails and chairrails may not have been painted until after the sink and cabinet shown in the 1876 plan were removed. The baseboards were added around the 1950's.

FIRST FLOOR: Room 120

Finishes:

Walls and ceiling:	Walls in Room 120 were originally light brown and painted medium olive in the 1880's.
Millwork:	Millwork was grained through the 1880's.

Alterations: Sash, ceilings, baseboards and the infill in the former doorway to Room 109 were added around the 1950's.

SECOND FLOOR: Room 201

Finishes:

Walls and ceiling: Walls and entablature were originally painted light yellow-brown. In the 1880's, walls were painted medium olive and the entablature three shades of olive.

Millwork: Baseboards and door trim were originally painted light tan and doors were grained. In the 1880's door frames, pilasters and door stiles were painted light olive, baseboards, plinths and recessed panels, dark olive. The northeast door was covered with red-brown graining.

Alterations: Bookcases were added on the south, east and west walls after the turn of the century. The present flooring was laid down at the same time. The top cornice moulding and accoustical tile ceiling were added recently.

SECOND FLOOR: Room 202

Finishes:

Walls and ceiling: Walls and cornice were originally yellow-brown and painted cream in the 1880's.

Millwork: Millwork was originally painted cream. In the 1880's, shades of light and medium pink-brown were applied in the same multi-chromatic pattern found in Rooms 103 and 104.

Alterations: Both the ceiling and the sash are relatively recent.

SECOND FLOOR: Room 203

Finishes:

Walls and ceiling: Walls and cornice were originally light yellow-brown and painted light brown and cream, respectively, in the 1880's.

Millwork: Millwork was originally cream and painted shades of pink-brown similar in pattern to Room 202 in the 1880's.

Alterations: The window sash, cornice moulding and wallboard in the shower stall and particle board ceiling were all added relatively recently. Plumbing fixtures are also modern.

SECOND FLOOR: Room 204 and 204A:

Finishes:

Walls and ceiling:	Walls were originally painted light yellow-brown, the cornice cream and ceiling a slightly darker cream. In the 1880's, walls were light grey or light brown, and the cornice varying shades of pink-brown and ceiling gray. Closet walls in 204A were unpainted.
Millwork:	Millwork was originally.light yellow-brown. In the 1880's, upper baseboards, door and window frames, shutters and doors were painted light brown and lower baseboards and recessed panels painted medium brown.

Alterations: The 1876 plans show a wall slightly west of the present west wall in 204A, evenly dividing the space between 204A and 205A. Sometime in the first half of the 20th century, a new wall with baseboard was constructed in the present location. Window sash and the lower cornice moulding were added relatively recently.

SECOND FLOOR: Room 205 and 205A

Finishes:

Walls and ceiling: Walls were originally painted light yellow-brown and the ceiling a light orange-brown. In the 1880's, walls were painted medium pink-brown, the cornice two shades of the same color and the ceiling dark grey.

Millwork: Millwork was originally cream in both 205 and 205A. In the 1880's, wood trim was painted two shades of pink-brown as in Room 202, 203 and 204.

Alterations: Plans dating from 1876 show neither the north closet in the northeast corner, nor the door leading to it. The east wall of the closet and the door and trim appear to date from the early 20th century. Window sash and the lower cornice mouldings were added relatively recently. As discussed under Room 204, the wall and closet shown in 205A in the 1876 plans were removed and a new partition added in the 20th century. Plumbing fixtures were probably added at this time.

SECOND FLOOR: Room 206

Finishes:

Walls and ceiling:	Walls were originally light yellow-brown and painted gray-brown in the 1880's.
Millwork:	Millwork was originally cream and painted grey-brown in the 1880's.

Alterations: As discussed under Room 205, the west wall was added in the 20th century. The accoustical tile ceiling and wallboard in the closet area were added recently.

SECOND FLOOR: Room 207

Finishes:

Walls and ceiling:	Walls were originally light yellow-brown and cornices gray-brown. In the 1880's, walls were light gold or olive with cream/light brown and light grey/gray brown cornices, respectively.
Millwork:	Millwork was originally painted cream. In the 1880's, it followed the bichromatic scheme found in Rooms 202, 204 and 205 with light and medium brown to match the gold walls or light and medium grey to match the olive.

Alterations: A door in the northeast corner of the room originally led to Room 208, as shown on the 1876 plans. Only one layer of wallpaper covers the infill for this door, indicating that the change was relatively recent. The sash, lower cornice moulding and ceiling were added in the last 20 years.

SECOND FLOOR: Room 208

Finishes:

Walls and ceiling: Walls have been recently covered with wall board and paper and tile wainscoting which obscure the original wall surface. The ceiling appears originally to have been light brown, and light grey-brown in the 1880's.

Millwork: Door and window frames, door and shutters were originally painted cream and then grained through the 1880's.

Alterations:

As discussed under Room 207, the door to that room was closed up relatively recently. Fixtures are all modern.

SECOND FLOOR: Room 209

Finishes:

Walls and ceiling: The south and east walls were originally painted light yellow-brown and the ceiling light grey-brown. In the 1880's, the walls were green and and the ceiling dark grey-brown.

Millwork: Millwork, including baseboards, stair treads and risers was grained through the 1880's. The door to 207 was painted cream and later light yellow-brown, the doors and frames to Rooms 210 and 211 and the frame to Room 201 were grained through the 1880's.

Alterations: The 1876 plans show curved steps leading to a landing with doors to 207 and 208. The door to 208 and stairs appears to have been changed in the 1880's or 1890's, but the lower stairs seem to be even later in construction. Ghosts of shelves appear on the north and south walls and the doorway to Room 207. Removal of the present stairs may disclose the original stair outline and more complete information on the changes.

SECOND FLOOR: Room 210

Finishes:

Walls and ceiling:	Walls were painted light yellow-brown originally and light grey-brown in the 1880's.
Millwork:	Millwork was originally grained but was painted grey-brown in the 1880's.

Alterations: The closet and door in the northwest corner of 210 were added in the 1880's and were painted the same grey-brown color. The ceiling and sash are relatively recent.

SECOND FLOOR: Room 211

Finishes:

Walls and ceiling:	Walls in 211 and the adjoining closet were yellow-brown originally and olive in the 1880's.
Millwork:	Millwork was grained until the 1880's, when it was painted cream.

Alterations: The north door leading to 210 is not shown on the 1876 plan but appears to have been original. The cornice moulding and ceiling date from the early 20th century. The original marble mantle has been painted white.

SECOND FLOOR: Room 212

Finishes:

Walls and ceiling:	Walls were painted light and yellow-brown originally and olive in the 1880's.
Millwork:	Millwork was grained until the 1880's, when it was painted cream.

Alterations: Sash and ceiling are both new.

SECOND FLOOR: Room 213

Finishes:

Walls and ceiling:	Walls and ceiling were first painted light yellow-brown. In the 1880's, walls were light grey-brown and ceilings light yellow-brown.
Millwork:	Millwork was grained until the 1880's, when it was painted grey-brown.

Alterations: Sash were recently replaced.

SECOND FLOOR: Room 214

Finishes:

Walls and ceiling:	Walls follow the same pattern as Room 213.
Millwork:	Millwork was originally grained and painted grey-brown in the 1880's.

Alterations:	The 1876 plan shows a doorway and tub room between rooms 214 and 215. The original surface on the south side of this wall is currently covered with wallboard, but the wainscoting dates from just before the 1880's.

SECOND FLOOR: Room 215

Finishes:

Walls and ceiling:	Walls were originally light yellow-brown and painted medium yellow-brown in the 1880's.
Millwork:	Millwork was grained until the 1880's, when it was painted cream.

Alterations: Sash and accoustical tile ceiling are recent additions. See alterations on Room 214.

ATTIC

Finishes:

Walls and ceiling: The walls and ceilings were originally whitewashed.

Millwork: Baseboards, window and door frames and doors were originally grained as was a portion of the closet. The south side of the closet has only the base coat for the graining. The exposed graining layer is the original.

Alterations: The two dormers in Room 305 were added at the turn of the century.

CUPOLA: Room 401

Finishes:

Walls and ceiling:	The walls were originally painted a light blue green, the cornice and ceilings were cream.
Millwork:	Baseboards and window frames were originally grained.

Alterations: The original sash were replaced at the turn of the century. The stair balusters were varnished until very recently when they were painted.

GARAGE

Finishes:

Millwork: The northwest garage door frame and the southwest door and frame were originally painted white and have mainly remained that color since construction in the 1930's. Neither the window frames or sash were accessible.

Masonry: Unpainted.

GATEHOUSE

Finishes:

Millwork:	The exterior door, door frames and window frames were originally painted a medium brown, very close in color to the sandstone trim on the building. All of the window sash have been removed.
Brickwork:	The exterior brick walls and chimney were originally painted with a lime-based paint light tan in color. This has been covered with the present red-brown layer of latex paint which has not bonded well with the previous layer.

Alterations:

The window openings have been covered with plywood.

II. MORTAR ANALYSIS

Samples of original mortar each weighing 5 to 8 ounces were removed from protected areas of the Arsenal, Commanding Officer's House, Garage and Gatehouse and subjected to laboratory analysis. Samples were tested to determine composition, proportions and aggregate size according to ASTM C-136 and ASTM C-85.

The samples were assigned the following letters to facilitate their processing in the laboratory:

A.	Main Arsenal	brick mortar
B-1.	Main Arsenal	watertable bed mortar
B-2.	Main Arsenal	watertable pointing mortar
C.	Commanding Officer's House	brick mortar
D.	Garage	brick mortar
E.	Gatehouse	brick mortar

Following are the results of the laboratory analysis and recommended mortar mixes to be used for repointing.

AMBRIC TESTING & ENGINEERING ASSOCIATES OF VA., INC.

REGISTERED ENGINEERS
• INSPECTORS •

TESTING LABORATORIES
• CHEMISTS •

4110 Wheeler Avenue
Alexandria, Va. 22304
(703) 370-3100

Report No. V-785

27 November 1978

Building Conservation Technology, Inc.
1010 Vermont Avenue, N.W., Suite 1117
Washington, D.C. 20005

Re: Test: ASTM: C 83, C 136, Chemical

Gentlemen:

Attached are results of tests taken on six (6) samples of hardened mortar.

Our laboratory work consists of determination of proportions of constituent materials, gradation of extracted aggregate and percentage of iron oxide content.

Test results are given in attached tabulation sheets nos. 1 and 2.

Respectfully submitted,

F. W. Williams

F. W. Williams, P.E.
Executive Vice President

WHP/FWW:bco
Attachment

SAMPLE IDENTIFICATION:	A - ARSENAL			B-1 - ARSENAL			B-2 - ARSENAL		
	Cement	Lime	Sand	Cement	Lime	Sand	Cement	Lime	Sand
PROPORTIONS % by weight	14.1	10.1	75.8	19.9	16.8	63.3	34.1	11.0	43.9
PROPORTIONS % by volume	11.07	18.63	69.92	14.67	29.1	54.82	29.73	22.54	44.98
Parts by volume	1	1.68	6.31	1	1.98	3.74	1	.76	1.51
RATIO Cementitious Material to Aggregate		1 - 2.35			1 - 1.26			1 - .86	
IRON OXIDE % by volume								2.75	
SIEVE ANALYSIS % passing									
No. 4		100.0			100.0			100.0	
No. 8		100.0			86.5			99.2	
No. 16		99.7			73.1			81.2	
No. 30		50.6			47.9			72.1	
No. 50		40.1			21.6			66.2	
No. 100		31.6			16.6			19.5	
No. 200		5.4			4.5			4.9	

MORTAR

SAMPLE IDENTIFICATION:	C - C.O.'S HOUSE			D - GARAGE			E - GATEHOUSE		
	Cement	Lime	Sand	Cement	Lime	Sand	Cement	Lime	Sand
PROPORTIONS % by weight	10.1	11.4	78.5	15.9	10.8	73.3	26.8	15.8	57.4
PROPORTIONS % by volume	7.81	20.72	71.36	12.36	19.73	66.96	20.08	27.82	50.53
Parts by volume	1	2.65	9.14	1	1.6	5.42	1	1.39	2.52
RATIO Cementitious Material to Aggregate		1 - 2.5			1 - 2.08			1 - 1.06	
IRON OXIDE % by volume								1.58	
SIEVE ANALYSIS % passing									
No. 4		100.0			100.0			100.0	
No. 8		99.5			86.8			100.0	
No. 16		79.5			74.9			90.4	
No. 30		60.2			61.6			87.6	
No. 50		43.0			36.9			42.1	
No. 100		19.4			20.9			36.1	
No. 200		3.8			6.4			7.2	

Main Arsenal

1. Brick Pointing Mortar

   a. Proportions:

      1 part by volume white portland cement
      1.7 parts by volume hydrated masons lime
      6.3 parts by volume sharp white sand

   b. Aggregate: shall be sized to conform to the following

Sieve Size	% Passing
No. 4	100.0
No. 8	100.0
No. 16	99.7
No. 30	50.6
No. 50	40.1
No. 100	31.6
No. 200	5.4

   c. Color: final mortar color shall be white

Note: White portland cement has been substituted for the natural cement used in the original mortar mix due to the inavailability of natural cement. Ultimate strength and appearance of the mortar will not be significantly altered by this substitution.

2. Stone Pointing Mortar

   a. Proportions:

      10 parts by volume white portland cement
      8 parts by volume hydrated masons lime
      15 parts by volume black and white sharp sand
      1 part by volume dry red iron oxide pigment

   b. Aggregate: Shall conform to the following size gradation and shall be an equal mix of black and white sharp sand.

Sieve Size	% Passing
No. 4	100.0
No. 8	99.2
No. 16	81.2
No. 30	72.1
No. 50	66.2
No. 100	19.5
No. 200	4.9

c. Color: Dry mortar color shall match Munsell Code $\frac{2.5YR}{4/4}$ and the color of the sandstone.

d. Joint finish: joints shall be flush with the surface of the stone and stippled to match stone texture.

Note: White portland cement has been substituted for the original natural cement.

Commanding Officer's House

1. Brick Pointing Mortar

   a. Proportions:

      1 part by volume white portland cement
      2.65 parts by volume hydrated masons lime
      9.14 parts by volume white sharp sand

   b. Aggregate: shall be sharp white sand conforming to the following size gradation.

Sieve Size	% Passing
No. 4	100.0
No. 8	99.5
No. 16	79.9
No. 30	60.2
No. 50	43.0
No. 100	19.4
No. 200	3.8

   c. Color: final mortar color shall be white.

   Note: White portland cement has been substituted for the natural cement used in the original mortar mix due to the inaccessibility of natural cement.

2. Stone Pointing Mortar

   See Main Arsenal, Stone Pointing Mortar.

Gatehouse

1. Brick Pointing Mortar

   a. Proportions:

      10 parts by volume white portland cement
      14 parts by volume hydrated masons lime
      25 parts by volume black and white sharp sand
      1 part by volume dry red iron oxide pigment

   b. Aggregate: shall be an equal mix of black and white sharp sand and conform to the following size gradation.

Sieve Size	% Passing
No. 4	100.0
No. 8	100.0
No. 16	90.4
No. 30	87.6
No. 50	42.1
No. 100	36.1
No. 200	7.2

2. Stone Pointing Mortar

   See Main Arsenal, Stone Pointing Mortar.

Garage

1. Brick Pointing Mortar

a. Proportions:

1 part by volume grey portland cement
1.6 parts by volume hydrated masons lime
5.4 parts by volume sharp white sand

b. Aggregate: shall conform to the following gradations.

Sieve Size	% Passing
No. 4	100.0
No. 8	86.8
No. 16	74.9
No. 30	61.6
No. 50	36.9
No. 100	20.9
No. 200	6.4

PAINT AND MORTAR ANALYSIS

PAINT COLOR - CAST IRON PORCH

Layer No.	Color	Munsell Code
1 (original)	medium brown	5YR 3/4
2	medium brown	5YR 4/2
3	medium brown	10YR 4/4
4	yellow brown	2.5Y 6/6
5	yellow brown	2.5Y 6/6
6	dark green	5G 2/2
7	yellow brown	2.5Y 7/6
8	dark brown	5Y 2/2
9	cream	5Y 8.5/2
10	white	5Y 9/1
11	white	5Y 8.5/2
12	white	5Y 9/1
13	white	N8.75
14	white	5Y 9/1
15	white	5Y 9/2
16	white	N9.25
17	white	N9.25
18 (existing)	white	5Y 9/1

APPENDIX B-5

COMMANDING OFFICER'S HOUSE HISTORIC HEATING SYSTEM

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

COMMANDING OFFICER'S HOUSE HISTORIC HEATING SYSTEM

prepared for the
National Park Service
by
Stull Associates, Inc. and
R.G. Vanderweil Engineers, Inc.

COMMANDING OFFICER'S HOUSE HISTORIC HEATING SYSTEM

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

Main Arsenal
Commanding Officer's House
Garage
Gatehouse

prepared for the
National Park Service
Basic Agreement No. CX-2000-8-0044
Work Directive No. 8-0044-78-01

March 6, 1979

by
Stull Associates, Inc.
431 Marlborough St., Boston, Massachusetts

and
R.G. Vanderweil Engineers, Inc.
52 Chauncy St., Boston, Massachusetts

TABLE OF CONTENTS

1. INTRODUCTION

The hot air heating system in the Commanding Officer's House dates back to the original (1847) construction, although extensive modifications to the system are evident. There is steam radiation in the building today, but it was installed at a much later period. This report presents our findings and conclusions on the historical development of these systems, focusing upon the original hot air system and modifications.

2. FIELD DATA

The following heating system components are in evidence:

a. Rectilinear grille floor and wall registers with wheel-operated dampers, on the first and second floors (Figure 1). These registers are typical of ones we have observed in late 19th and early 20th century buildings.

b. Circular "spiral-grille" floor registers on the first floor (Figures 2 and 3).

c. Three masonry heating chambers in the basement. These contain steam fin tube heating coils and feed three respective systems of hot air ductwork (Figure 4 and Figures 14-17).

d. Two fresh air intake tunnels in the basement: a common tunnel for the two heating chambers in the main section of the house and a separate one for the wing heating chamber (Figure 5).

e. A 1/2" valved humidification water supply near the entrance to each furnace. In one of the furnaces this continues into the heating chamber where the 1/2" tube is coiled on top of the fin tube, perforated with pin holes, and pinched off at the end.

f. Original coal and coal ash storage chamber underneath the front porch and accessible from the basement.

g. Four fireplaces each on the first and second floors of the main section of the house (i.e. one in each room; total of eight fireplaces; none in the attic).

h. A metal fireplace radiator shield on one of the fireplaces on the second floor of the main section of the house (Figure 6). Field inspection failed to reveal any indication of the date of manufacture.

i. Two fireplaces on the second floor of the wing.

j. Capped, rectangular, sheet metal duct stubs in rooms B03 and B07, below the fireplaces in rooms 104 and 108; remnants of ash chutes.

k. Masonry ash chutes for two fireplaces in the main section of the house, rooms 108 and 202.

l. Iron swing doors at two openings into the masonry chimney base in the wing basement which appear to be ash doors; typical of iron doors found in old residential coal boilers.

m. Five small openings (approximately 6" x 8") with hinged steel doors, just above the baseboard in the main attic on the southeast and northwest walls, which open into the wall cavity (Figure 7).

n. Two sets of fairly recent thermostats and humidistats in the first floor hallways, controlling the heating chambers.

o. Cast iron steam radiators in the first and second floor bathrooms.

p. Five chimneys: four in the main house and one in the wing.

Figures 14-17, at the end of this report, contain our inventory of the historic hot air heating system.

3. ANALYSIS - DEVELOPMENT OF HEATING SYSTEMS

Based on our knowledge of nineteenth and twentieth century heating practices we can form a hypothesis about the historical development of the system that accounts for most of our field observations. However, some significant questions remain unanswered; their resolution, like the verification of our systems hypothesis, must await the discovery of additional construction documentation. Our hypothesis of the system and its development follow.

Gravity System, Masonry Flues, Historic Floor Registers. The original 1847 heating system, like most other institutional* systems of its day, was a coal fired gravity hot air system. Hot air rose from the basement to the various rooms via masonry flues which are integral with the chimneys and therefore were part of the original construction. Although changes have been made so that fireside floor registers are found in only a few rooms, we believe that originally the hot air entered each room through a floor register located beside the fireplace. As registers go, the remaining samples are magnificent and are certainly historically significant (Figures 2 and 3). These registers are circular, are set in a marble surround, and have elegantly curved spiral openings with a matching spiral cover which is manually rotated to restrict or permit air flow. The typical location for these, with respect to the fireplace, is illustrated by Room 204, as shown in Figure 16.

Fireplaces, Ash Chutes, Gravity Exhaust. Nineteenth century heating systems were almost always "100% fresh air", with no return and recycling of heated air as in a modern day system. Although there is a question of an attic return system at the Commanding Officer's House (discussed below) we believe that the heating system was basically a 100% fresh air system. Fresh air was introduced from the outside to the furnace at the cellar

---

*Residential systems in New England depended primarily on fireplaces for heating, but furnaces with sheet metal ducting did start to spread in the mid-nineteenth century. It is our experience that masonry flues were more typical than sheet metal for institutional projects.

level, was heated, rose to the rooms, and displaced room air out of the fireplace flues. Thus, the damperless fireplace flues acted as exhausts.

The fireplaces themselves were operable, so the gravity warm air heating system could be supplemented. There is evidence that an ash chute was originally built into each fireplace below the grate. This lead to one of four ash closets in the basement. One fireplace has a masonry ash chute; other ash chutes were rectangular sheet metal ducts, as indicated by the two existing capped stubs (Figure 14).

By the time the 1876 plans were drawn, three of the four ash chutes from the second floor fireplaces had been bricked over. The fourth ash chute had been converted to a hot air supply, and the floor register in this room had been floored over. Similarly, three ash chutes from the first floor had been converted to hot air supply and adjacent registers covered. Evidence of flooring over a register can be seen through a hole in the basement ceiling beneath Room 104. The fourth ash chute on the first floor had been bricked over and the floor register relocated to the inside partition.

Heating Chambers

The heating chambers as now existing are rectangular masonry structures with steam fin tube installed within. The fin tube creates rising convection currents which supply the flues with hot air. Steam comes from a district heating system.

Presently, there are three heating chambers in the cellar, two in the main building and one in the wing. Two of these are free standing brick structures, the third is built into the base of the two south chimneys in the main building. The three chambers supply hot air to the flues built into the chimneys. The heating chambers have barrel vaulted roofs just below which are flat metal top-plates that cover the entire top of the chambers. This top-plate has small cutouts for each supply duct. Originally, the steam piping in heating chambers was probably several horizontal banks of pipes, but now each heating chamber has steel fin tube steam radiation suspended about halfway between floor and top plate.

We are unable to resolve whether the three chamber scheme was original. As engineers, we strive for systematic repetive solutions to today's design problems, and assume that our forebears did the same. Then why are two of the chambers different from the third?

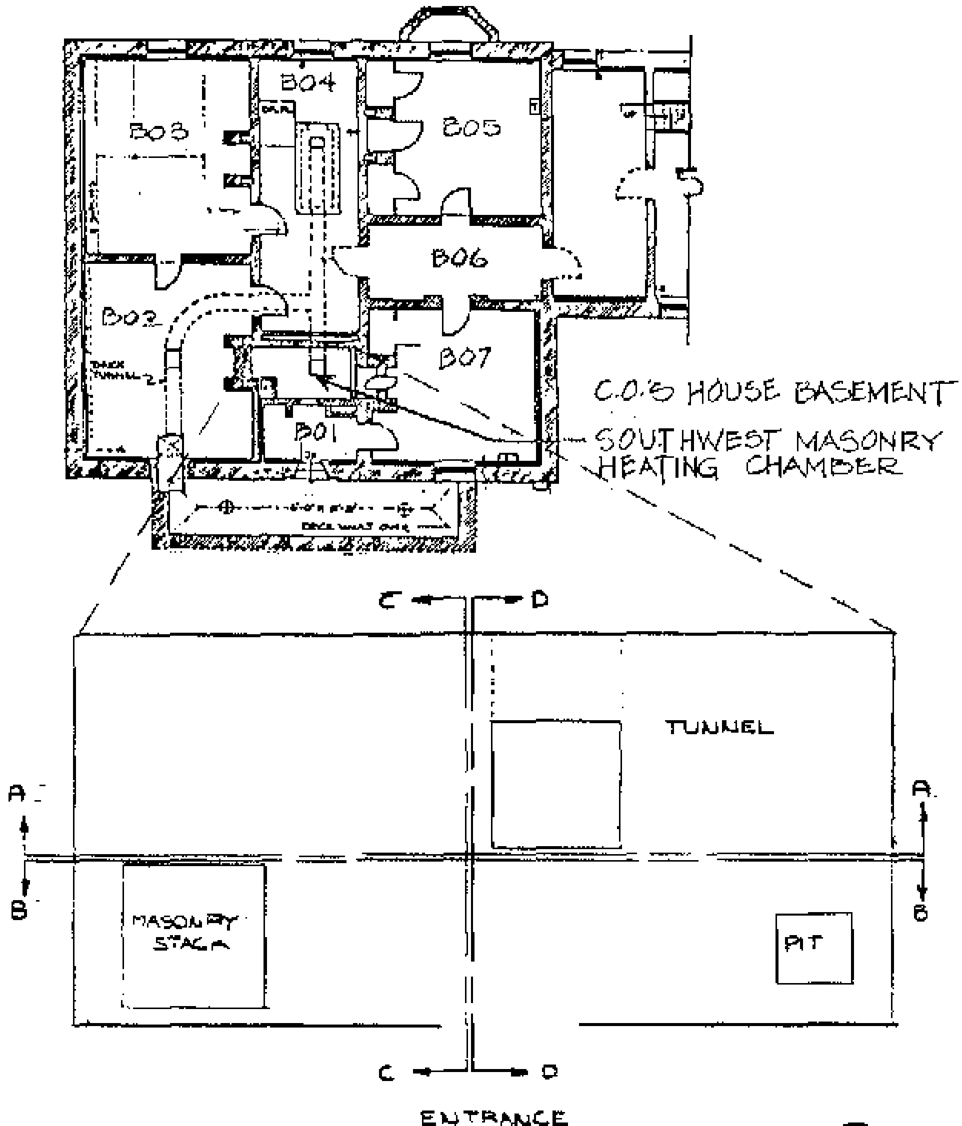
Given that masonry flues were originally built into the five chimneys, one would expect that three identical furnaces would have been employed to serve their respective flue systems. It is possible that masonry flues were not original to the wing but were original only to the main house. In this case, the chamber built into the two south chimneys of the main house could have been the only heating chamber, feeding both sets of flues in the main house. There is evidence of capped ductwork that might originally have connected the north flues to the south heating chamber. The location of the coal vault supports this hypothesis. It appears to be specifically located to serve this heating chamber easily; the routes from coal vault to the other two heating chambers are circuitous. Under this scenario, the wing would have originally been unheated. At some point the two free-standing heating chambers were built, one serving the two north chimneys of the main house, the other serving the wing.

An alternate scenario is that originally there were three coal fired furnaces serving the three flue systems as shown in the 1876 plans. These were then replaced with heating chambers, possibly in 1906 when district heating was installed at the Armory.

We do not believe that an 1847 structure would have one central boiler sending steam or hot water to multiple heating chambers. This central approach came into use in larger buildings some 20 years later and, unless this was a very early trial, it is doubtful that it was employed here, expecially considering the infant state of the art in steam and hot water systems at the time.

Details of the unique south heating chamber are shown in Figures 8-13.

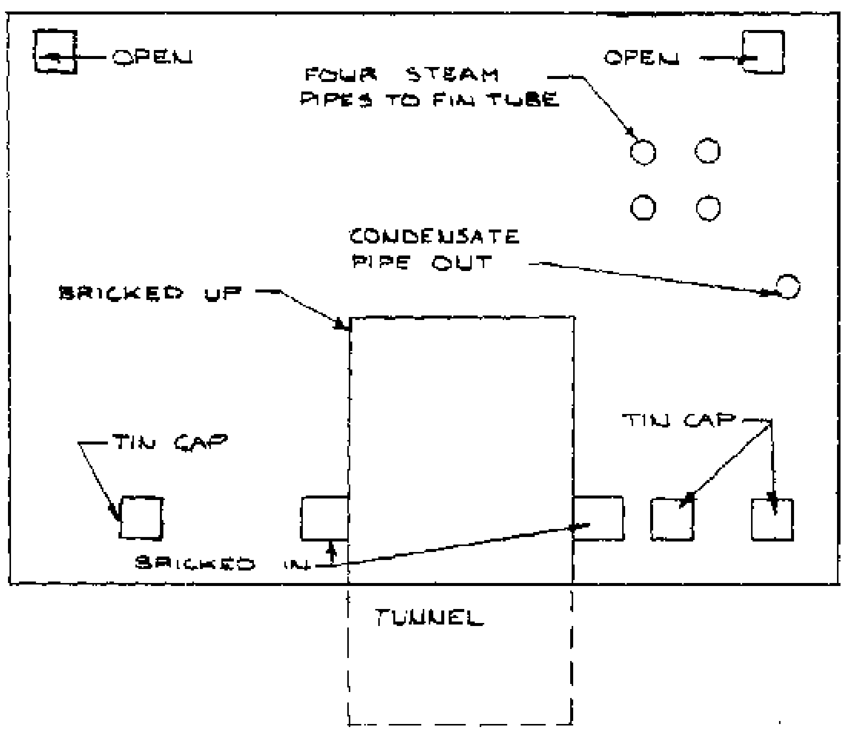
This chamber has a total of 19 flue openings, twelve of which are capped or bricked over. only one opening (still in use) exists in the top plate; the remainder are in the walls of the chamber. Some of these openings are low in the walls of the chamber and therefore useless for gravity heating. The purpose of these openings is still uncertain It can be conjectured that these formed part of a return system, discussed later.



PLAN OF CHAMBER (SCHEMATIC)

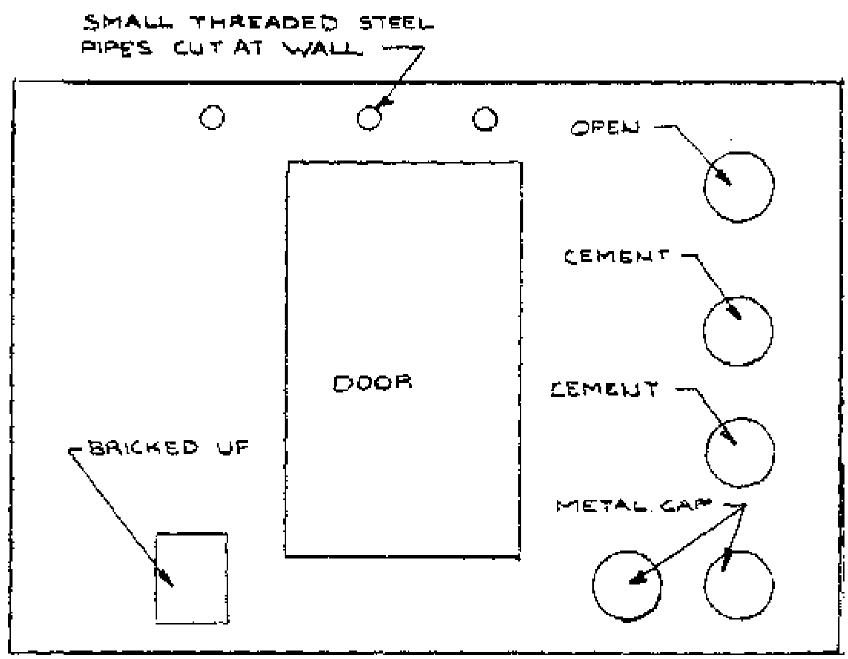
R. G. Vanderweil Engineers	Project SPRINGFIELD ARMORY C.O. HOUSE	Number FIG. 8
52 Chauncy Street, Boston, MA 02111	Title SOUTHWEST MASONRY HEATING CHAMBER	Date JAN 1979
		Scale NTS

ELEVATION AA



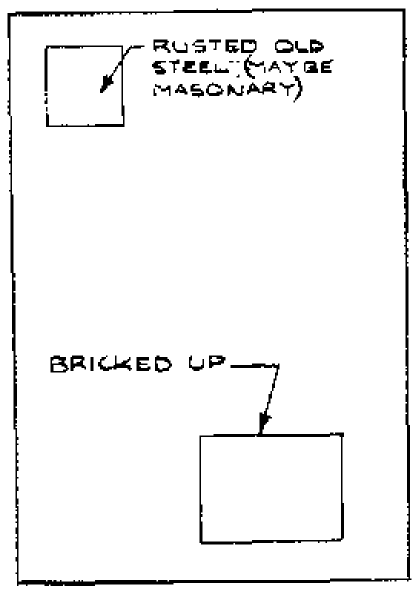
R. G. Vanderweil Engineers 52 Chauncy Street, Boston, MA 02111	Project SPRINGFIELD ARMORY C.O. HOUSE	Number FIG. 9
	Title SOUTHWEST MASONRY HEATING CHAMBER	Date JAN. 1979 Scale NTS

ELEVATION BB



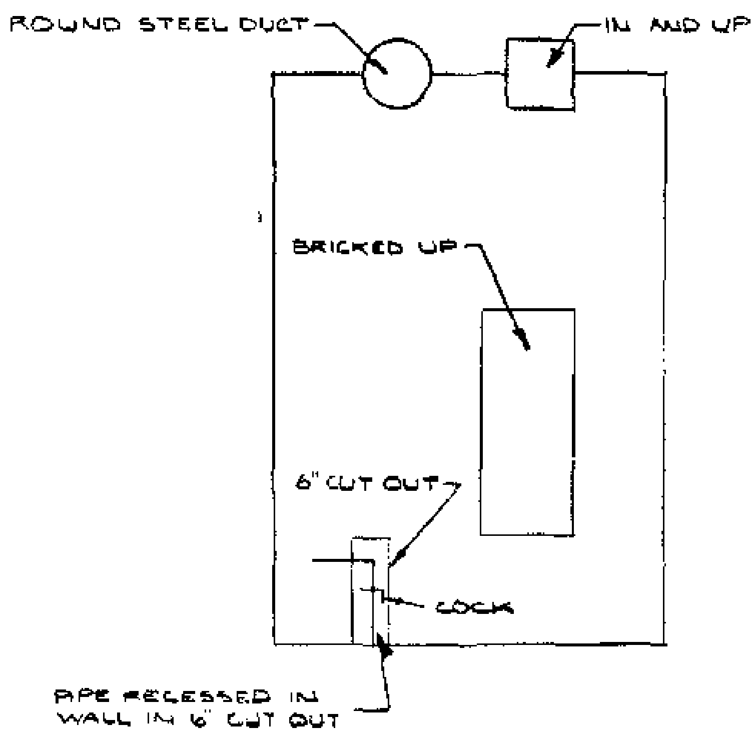
R. G. Vanderweil Engineers	Project SPRINGFIELD ARMORY C.O HOUSE	Number FIG. 10
52 Chauncy Street, Boston, MA 02111	Title SOUTHWEST MASONRY HEATING CHAMBER	Date JAN 1979 Scale NTS

ELEVATION CC



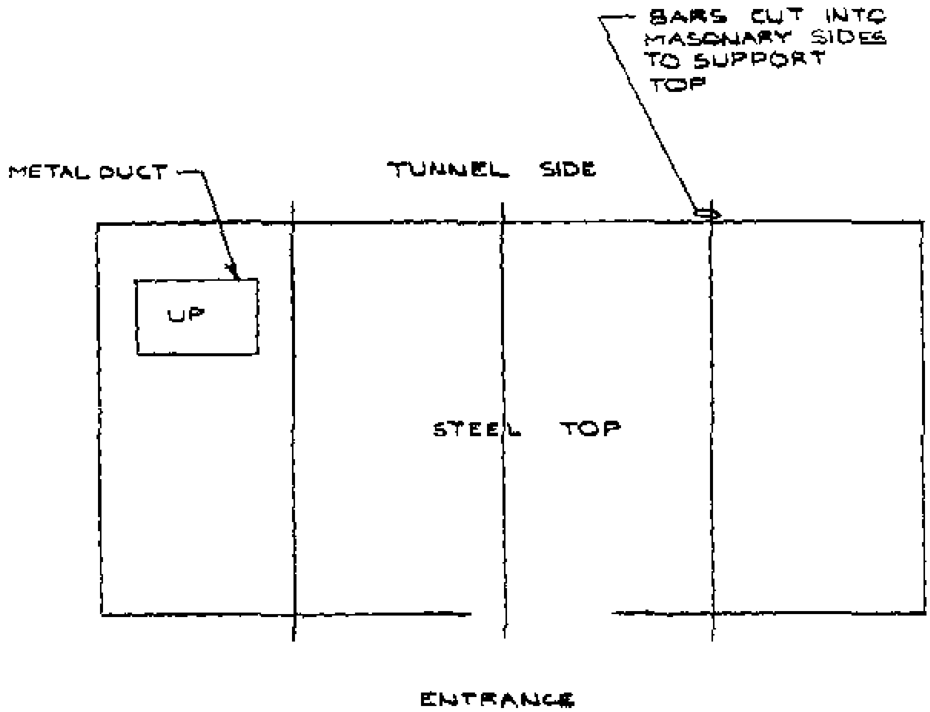
R. G. Vanderweil Engineers 52 Chauncy Street, Boston, MA 02111	Project SPRINGFIELD ARMORY C.O. HOUSE	Number FIG. 11
	Title SOUTHWEST MASONRY HEATING CHAMBER	Date JAN. 1979 Scale NTS

ELEVATION DD



R. G. Vanderweil Engineers	Project SPRINGFIELD ARMORY C.O. HOUSE	Number FIG. 12
52 Chauncy Street, Boston, MA 02111	Title SOUTHWEST MASONRY HEATING CHAMBER	Date JAN. 1979 Scale NTS

REFLECTED CEILING PLAN



R. G. Vanderweil Engineers	Project SPRINGFIELD ARMORY C.O. HOUSE	Number FIG. 13
52 Chauncy Street, Boston, MA 02111	Title SOUTHWEST MASONRY HEATING CHAMBER	Date JAN. 1979 Scale NTS

Fresh Air Intake

Presently, the fresh air intake for the gravity heating system is from cellar window intake louvers which are ducted down into brick tunnels in the cellar floor. (See Figure 14.) We believe this was the original method but it cannot be verified. An optional method would have been merely to open cellar windows, but this was not commonly done.

Energy Source

As noted, coal was the original energy source for the heating system, and, sometime in 1906 or later, a conversion to district steam was made. Coal was originally stored in a large chamber underneath the front porch. Two manholes at grade below the porch (labelled "coal" and "coal ash" on the 1876 plans) and an iron plate door from the basement provided access to the coal storage.

Relationship of Cavity Wall to Original Heating System

The 1876 plans show a cavity wall in the building, and we have verified its existance in the main house by dropping a plumb bob from the attic. The cavity descends from the attic to basement floor level. The attic contains five small openings with steel access doors, located just above the baseboard on the north and south walls of the attic, (see Figure 17)which open into a 6"x18" shaft which drops several feet and then opens to the full cavity. The wall is open horizontally (not ducted) with brick headers as ties at regular intervals. Since there are no headers in the elevations, we guess the cavity wall is 20" with 8" wythes and a 4" cavity with the headers in the interior wythes. The second floor wall is about 22" thick which leaves some 2" for strapping, lath and plaster. It appears that the exterior wall at the attic is 8" exterior masonry, 6" cavity (4" + 2" projection), 4" interior masonry and 6" stud wall and plaster.

Since the 1876 drawings show a connection between the cavity wall and the south heating chamber in the wall (between B01 and B02), it was conjectured by the Park Service that perhaps the cavity wall was associated with the heating system. Another possibility is that the cavity wall was one of many experiments on the control of moisture in walls undertaken during this period (e.g. the oiling of the walls of the Arsenal building).

Based on the analysis of the existing heating system given above, we believe that the cavity wall was not a functional part of the heating of the first and second floors. Since the cavity is connected to the attic, the possibility of a link to an attic heating system exists. Our knowledge of hot air behavior leads us to believe that a gravity supply of hot air to the attic from the south chamber would not have been possible. First of all, there is no fireplace flue leading from the attic to exhaust the air (an operable skylight would not work, since heat loss would exceed heat supply). Second, gravity does not provide enough motive force to spread the heat from the chamber around the four walls of the house - rather the heat would rise locally at the closest point to the chamber. Third, the masonry in the first floor wall just above the heating chamber would absorb most of the heat, allowing little, if any, to reach the attic. Fourth, if the intent was to supply heat to the attic, it would have been simple and systematic merely to extend a masonry flue to the attic as to the other rooms, particularly since the chimneys go right through the attic.

Discounting the use of the cavity wall as an attic supply, the possibility of its use as a "return" arises. Our inclination is to discount this as well, merely because we are not aware of any return systems this early. Typically, heating systems were 100% outside air, with no return (sometimes called "once through" systems). Therefore, the doors from the cavity to the attic would only have been for moisture control.

In spite of our inclination to the contrary, a case can be made that the cavity functioned as a return system. In the south heating chamber, there are bricked up low openings, and low openings (below the steam coils or other heat transfer medium) are proper for return. In this scenario, hot air supplied to the first and second floors by the heating system would rise by gravity and enter the attic. The five doors from the attic to the cavity would be opened, permitting the cold downdraft in the cavity (caused by heat transfer out the wall) to suck return air back down to the heating chamber. (An incidental benefit of this return air route is heating of the attic.)

The 1876 drawings show a cavity to heating chamber connection in the southwest wall of room B01 (Figure 14). Field observations also indicate the possibility of a second connection running in the northeast wall of room B01. Both connections join the cavity in the southeast wall of the house to the southeast wall of the heating chamber. The chamber appears to have double walls in the southeast and northwest sides. The northwest double wall is visible in Figure 14; the southeast wall appears to have been a double wall on each side of the entrance to the heating chamber, although the westerly half is no longer double.

Under this hypothetical return system, air would enter the attic openings and, cooling, fall down the wall cavity, through the southeast wall connections, into the southeast double wall of the heating chamber, and then through low openings into the chamber itself. However, it could not have passed through the wall connections from the southeast, over the chamber to the northwest double wall because the return air would be heated in passing over the chamber and then could not sink down to the openings into the chamber. For these (northwest) return openings, one would postulate a connection from the northwest exterior wall of the house to the northwest double wall of the heating chamber. There is no visual evidence of such a connection.

This hypothetical return system would compete with the fireplace flues (which attempt to exhaust the air supplied to each room) which did not have dampers.

In fact, the return could have overcome the flues only if there were no cellar fresh air intake system to the heating chamber(s). Therefore, whether or not the existing fresh air intake system was original becomes critical to the hypothesis of a return system. If it did exist, the outside source of fresh air, combined with the exhaust through the fireplace flues, would effectively short circuit the cavity return. If it didn't exist, perhaps the connection of the cavity to the south heating chamber shown on the 1876 drawings was indeed one of the earliest return systems.

Later modifications to Heating System

Modifications since the heating chambers were converted to district heating in 1906 have included:

- bricking over two first floor ash chutes and installing side-wall hot air registers,
- installing a floor register in room 108 in addition to the existing hot air supply through the original ash chute,
- installing a side-wall register below the sink in front of the "closet" between the south bedrooms (room 203). All wall registers and some floor registers are rectiliniear grilles with wheel-operated

dampers, dating from the early 1900's (cf. earlier description of original floor registers and Figures 1, 2, and 3).

- steam radiators were installed in several rooms, mainly in bathrooms in the wing
- steel fin tube replaced the original steam piping in the heating chambers. (Steel fin tube was first used when fin tube was developed in the 1930's and 1940's.)

APPENDIX C

United States Department of the Interior

NATIONAL PARK SERVICE

North Atlantic Region
15 State Street
Boston, Massachusetts 02109

IN REPLY REFER TO

NAR (P)

DENVER Service Center
Action
JUN 19'81

June 12, 1981

Memorandum

To: Files

From: Associate Regional Director, Planning & Resource Preservation

Subject: Trip Report - Springfield Armory - May 29, 1981

The purpose of the trip to Springfield was to arrive at decisions affecting the future development of the armory absent the completion of the Development Concept Plan. The DCP is on hold pending the revision of the cooperative agreement with Springfield Technical Community College. The basis for discussion was the chart listing alternatives contained in a draft DCP (copy enclosed). Each element of the chart and the decision reached is listed below.

Visitor Use/Interpretive Core: Agreed upon Alternative 2

Visitor Access and Parking: Agreed upon Alternative 1 while recognizing the need for better signing. It was suggested that we discuss with the College, the problem of bringing visitors through the College parking area and whether it would be possible to consider redesigning the parking area to allow safer access to the park.

Cultural Resources: Agreed that structures and grounds will be preserved as they existed in 1968. Under this concept, the loading dock stays: the Park feels very strongly that interpretive possibilities would be enhanced by removing the loading dock. All recognize that preservation policy might change and if so, some time in the future a stronger argument for removing the dock may be presented. Selecting a no-action alternative on the dock preserves that option.

Building 1: Since we agreed to move Administrative Headquarters to Building 13, this frees up the interior of the Commandant's House for other uses. We agreed that the new guidelines to be issued under the revisions to the Historic Preservation Act will be the basis for arriving at a leasing proposal for the Commandant's House.

Building 10: Agreed that the Park will issue a short-term Special Use Permit, probably 1 year, to the Springfield Police Department for use of the building as an office. This permit should not allow any further modifications to the interior of this building.

A short-term action item is to use available lapse monies to do some downspout and roof work on this building. The problem is finding a project supervisor to do this project. The work was originally scheduled for this spring, but the freeze on hiring personnel caused us delay in a Salem project which, when completed, will free up an individual to do the work at Springfield. I will discuss this problem with Blaine Cliver.

The Park will issue a one-year permit to the Springfield Police Department for construction of an horse corral and exercise area in the playing field in front of and to the right of Building 10. This permit must require the restoration of the site to its present condition when the permit expires.

Building 13: Basement will be used for storage and utilities. First floor will be used for interpretive exhibits and in the future an area for an audio/visual presentation. The second floor will be used for storage, library/workshop, and administrative purposes. Additional fire escapes will be necessary when these uses occur on the second floor. Third floor--for the time being, this floor will remain vacant. The idea of placing insulation directly on the floor is acceptable.

Building 33: This building will be stabilized. No use is proposed.

Landscape: When the Army area was declared excess in 1968, the City regraded the terraces in front of the arsenal building and Building 10 to create playing fields. They also used the area behind the Commandant's House as a dump area for trash, limbs, leaves, etc. The Army had terraced the area originally because of an erosion problem. The area is generally wet and contains a number of springs. The regrading by the City to create playing fields has caused the erosion problem to reappear. The steep slopes adjoining the playing fields are also hard to mow and there is a possibility, because of their steepness, that they will slough. The trash area behind the Commandant's House is a haven for rats and is generally messy in appearance. We agreed that the Park would send us a sketch map of their ideas on how this area should be regraded. Generally, the Park is thinking of returning the terraces to their 1968 appearance. There may also be an option that would allow us to simply regrade the area to prevent further erosion and to allow gentler slopes for mowing. In my estimation, moving earth around to the degree that appears to be necessary may be a major project costing several hundred thousand dollars. Lesser work to solve admittedly severe problems with erosion and mowing should cost less. We will await the Park's submission of the sketch map. In any case, we did agree the pool, rose garden, etc. would not be recreated.

The Park agreed to send us a list of the new Board of Trustees for Springfield Technical Community College.

The City sidewalks adjoining the site are generally in bad condition. We agreed, however, that the Park would accept no responsibility for maintaining those sidewalks. The Park can, however, remove grass, weeds, and trash in the area between the sidewalk and the wall surrounding the armory to prevent deterioration of the wall.

This report will serve as guidance for development purposes pending the completion of a DCP.

Charles P. Clapper

Enclosure

Concurred Steven H. Lewis

Steven H. Lewis
Acting Regional Director

cc: Acting Regional Director, NAR
Superintendent, Springfield Armory NHS
E. Kallop, Operations, NAR
D. Pitcaithley, Cultural Resources, NAR
N. Nelson, Planning & Design, NAR
Assistant Manager, Team North Atlantic, DSC
Preservation Center, NAR

CClapper_____

A3027
NAR (P)

May 13, 1981

Memorandum

To: Superintendent, Springfield Armory National Historic Site

From: Acting Regional Director, North Atlantic Region

Subject: Future Use of Springfield Armory Buildings

A few facts and/or assumptions about Springfield Armory -

We have started negotiations with the Community College to amend the cooperative agreement. This negotiation process will take time.

The Development Concept Plan, which is to serve as the guiding document for Springfield, is being held in abeyance pending the outcome of our negotiations with the College.

Even though we were successful in justifying and receiving development dollars for initial rehabilitation of the structures at Springfield, it is unlikely that additional big development dollars are forthcoming.

It is possible to accomplish a number of projects at Springfield using cyclic, repair/rehab, maintenance add-on, lump sum, lapse programs.

A lot of people have already decided what directions we should take at Springfield.

It is a matter of formalizing and agreeing upon those decisions.

Even though we cannot formalize the Development Concept Plan until we complete our negotiations with the College, it is possible to set down our decisions on the future development so that we can move forward using dollars other than development programs. A meeting has been set up for May 29 at Springfield to make the decisions necessary for us to proceed with projects that may be funded through cyclic, lump sum, etc.

The primary issue seems to be: building use, that is, space allocation within Buildings 1, 13 and 10; interpretation and the effect on building restoration, and the landscaping and parking.

Enclosed with this memorandum are copies of selected pages from the draft Development Concept Plan. The information is general, but I believe the charts can be used as a systematic method of determining what decisions need to be made.

Basic reference documents available for Springfield are the Statement for Management, Assessment of Alternatives (draft), Cooperative Agreement (current), Cooperative Agreement (revisions), and the Interpretive Prospectus. For those of you in the Regional Office, I have put together one set of these documents and they are available for your perusal at Ronnie's desk in the office of Planning & Resource Preservation. I urge that you familiarize yourself with them prior to the meeting on the 27th.

FOR

Steven H. Lewis

Enclosures

cc: Deputy Regional Director
Acting Associate Regional Director, Operations
Associate Regional Director, Administration
Cultural Resources
Preservation Center
Compliance
Planning & Design
Assistant Manager, Team North Atlantic/DSC

CClapper:vca 5-11-81

DESCRIPTION	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (EMPHASIS ON GUN COLLECTION & ARSENAL)	ALTERNATIVE 3 (EMPHASIS ON HISTORIC SITE)	OPTION A	OPTION B
Visitor Use/ Interpretive Core	Gun collection is dominant feature; no interpretation or use of the other features of the historic site.	Arsenal and gun collection dominant features; with minimum interpretation and use of the historic site administered by the NPS.	Same as Alt. 2; but with broad interpretation and use oriented toward all of the National Historic Site.		
Visitor Access and Parking	Existing access and parking.	Access through State/ Byers Street gate-parking south of Bldg. 13; new exit gate; buses and oversized vehicles through existing entrance-parking at north end at rose garden site.	Access from Federal Street through SICC with traffic circulation pattern reversed-parking at north end of rose garden site.	Access off Byers Street-parking in meadow; new gate; handicapped visitor parking in front of Bldg. 13.	
Cultural Resources	Existing protection and maintenance. Strict preservation.	Greater protection. Exterior preservation and adaptive use.	Same as Alt. 2. Selective restoration of specific features.		
Historic Structures Building 1	Administration and storage.	On-site park staff quarters and storage.	Administration, interpretation, and community use.		
Building 13	Arms collection and museum.	Same as Alt. 1, and including administration.	Same as Alt. 1.		
Building 10	Stabilized as a static resource. Preservation uncertain.	Stabilized and preserved indefinitely in place; storage.	Restored and relocated to original location; interpretation and storage.		Relocated to rose garden site; stabilized and used for storage.
Building 33	Stabilized as a static resource.	Control point at entrance gate.	Same as Alt. 1.		
Landscape	Maintain existing landscape conditions.	Same as Alt. 1; including planting of trees on hilltop; develop screening berms, regrass present parking area.	Regrade area west of Building 13 and replant with grass and trees; replace hedges, rose garden, fountain pool, and wetland vegetation in vicinity of spring.		
Cooperative Agreement	No negotiation in existing agreement. Use of the street in front of Building 13 uncertain.	No need for renegotiation of agreement.	Need to renegotiate cooperative agreement to continue use of the street in front of Building 13.	No need for renegotiation of agreement.	
			[illegible]000 500	Reduces Alt. 3 by $20 400	Reduces Alt. 3 by $216,00[illegible]

.CRIPTION	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (EMPHASIS ON GUN COLLECTION & ARSENAL)	ALTERNATIVE 3 (EMPHASIS ON HISTORIC SITE)	OPTION A	OPTION B
.PACTS					
a Visitor Appreciation and Understanding	Would remain the same; gun collection the dominant feature with little interpretation of surrounding site.	Increased through better interpretation; Arsenal and gun collection the dominant feature, but interpretation expanded to include more of the historic site administered by the NPS.	Same as Alt. 2; much broader understanding of armory with interpretation expanded to include the entire National Historic Site.	Not applicable.	Not applicable.
a Visitor Use	Use will remain the same.	Increased use of Arsenal and its immediate site.	Same as Alt. 2, but use of entire historic site and including armory grounds tie-in to city tour route.	Not applicable.	Not applicable.
Visitor Access nd Parking	Existing access circuitous and confusing; existing parking impermanent because of Cooperative Agreement.	Access improved but buses and oversized vehicles have somewhat confused access. Utilize historic access.	Access improved, but would require change of traffic patterns in the portion of the National Historic Site administered by STCC.	Provide a non-vehicular access, inconvenient on inclimate days.	Not applicable.
a Cultural Resources	Existing protection and maintenance of arms collection and buildings would continue.	Greater protection with park staff living on-site. Exit new to site-never existed before.	Same as Alt. 2, but using security patrolmen.	Access new to site-never existed before.	Preserves Bldg. 10.
	Possible demolition of Building 10.	Preserves Bldg. 10.	Preserves and restores Building 10.	Not applicable.	Preserved Bldg. 10.
a Landscape	Existing management would continue.	Planting trees would screen modifications in slope.	Partially restoring historic slopes and planting trees would reduce erosion; reconstruction of landscape features would more closely reflect the historic scene.	Need to remove wet conditions at site.	Provide screening of parking & gardens.
Cooperative Agreement and Relationship with STCC	Limits use of street in front of Bldg. 13; Future of parking dependent on College.	No need for renegotiation of agreement; little contact with the College.	Need to renegotiate Cooperative Agreement to continue use of street in front of Bldg. 13; seek concurrence to reverse traffic patterns; greater contact with College.	No need to renegotiate Cooperative Agreement.	Not applicable.

...CTS AS DEFINED ... OF CFR 800 ...ITERIA	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (EMPHASIS ON GUN COLLECTION & ARSENAL)	ALTERNATIVE 3 (EMPHASIS ON HISTORIC SITE)	OPTION A	OPTION B
...O EFFECT	Landscape maintenance.	Interpretive walks and waysides.	Curbing at exit gate.		
	Maintenance of Bldg. 33.	Quarters and Storage in Building 1.	Interpretation, administration and community activities in Bldg. 1.		
	Maintenance of Bldg. 18.	Preservation of Bldg. 33.	Maintenance of Bldg. 33.		
	Administration and storage in Bldg.				
...FECT	Museum in Bldg. 13.	Museum and administration in Bldg. 13.	Museum in Bldg. 13.		
		Replanting according to historic documents.	Foliage screen in rose garden.		
		New handicapped ramp at Bldg. 13.	Interpretive walks and waysides.		
		Preservation of Bldg. 10 with long-term protection.	Reconstruction of rose garden.		
			Reconstruction of rose arbor.		
			Reconstruction of fountains and hedges.		
			Regrading and replanting historic slopes.		
			Removal of tennis courts and walks.		
...ADVERSE EFFECT	Preservation of Bldg. 10 with no long-term protection.	New parking lot and berms.	New parking lot in rose garden.	New gate on Byers Street.	Relocation of Bldg. 10 to rose garden and stabilization.
		New exit road and gate.	Removal of loading dock, new handicapped lift and reconstruction of entrance.	New parking lot in meadow.	
		Oversized vehicle parking lot in rose garden.	Relocation and restoration of Bldg. 10 on its original site.		

APPENDIX D

ENABLING LEGISLATION

Public Law 93-486
93rd Congress, H. R. 13157
October 26, 1974

An Act

88 STAT. 1461

To provide for the establishment of the Clara Barton National Historic Site, Maryland; John Day Fossil Beds National Monument, Oregon; Knife River Indian Villages National Historic Site, North Dakota; Springfield Armory National Historic Site, Massachusetts; Tuskegee Institute National Historic Site, Alabama; Martin Van Buren National Historic Site, New York; and Sewall-Belmont House National Historic Site, Washington, District of Columbia; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Historic sites and national monument. Establishment.

TITLE I

SEC. 101. (a) Unless otherwise provided hereafter, the Secretary of the Interior (hereinafter referred to as the "Secretary") is authorized to acquire by purchase with donated or appropriated funds, donation, exchange, or by transfer from another Federal agency such lands and interests in lands as hereafter provided for establishment as units of the national park system, as follows: Land acquisition.

(1) for establishment as the Clara Barton National Historic Site, Maryland, those lands depicted on the map entitled "Boundary Map, Clara Barton National Historic Site, Maryland", numbered NHS–CLBA 80,001 and dated February 1974, which shall include the land and improvements occupied by Clara Barton, founder of the American Red Cross located at 5801 Oxford Road, Glen Echo, Maryland: *Provided*, That the above-mentioned land and improvements may be acquired only by donation: *And provided further*, That the donation of any privately owned lands within the historic site may not be accepted unless and until the property is vacant; Clara Barton National Historic Site, Md. 16 USC 461 note.

(2) for establishment as the John Day Fossil Beds National Monument, Oregon, those lands depicted on the map entitled "Boundary Map, John Day Fossil Beds National Monument", numbered NM–JDFB–20,014–A and dated June 1971: *Provided*, That the national monument shall not be established unless and until the State of Oregon donates or agrees to donate the Thomas Condon-John Day Fossil Beds, Clarno, and Painted Hills State Parks: *Provided further*, That the Secretary shall not acquire a fee title interest to more than one thousand acres of privately owned lands except by donation or exchange: *Provided further*, That the Secretary shall designate the principal visitor center as the "Thomas Condon Visitor Center"; John Day Fossil Beds National Monument, Oreg. 16 USC 431 note. Thomas Condon Visitor Center, designation.

(3) for establishment as the Knife River Indian Villages National Historic Site, North Dakota, those lands depicted on the map entitled "Boundary Map, Knife River Indian Villages National Historic Site, North Dakota", numbered 468–20,012 and dated July 1970; Knife River Indian Villages National Historic Site, N. Dak. 16 USC 461 note.

(4) for establishment as the Springfield Armory National Historic Site, Massachusetts, those lands depicted on the map entitled "Boundary Map, Springfield Armory National Historic Site, Massachusetts", numbered NHS–SPAR–91,003 and dated January 1974, the oldest manufacturing arsenal in the United States: *Provided*, That the historic site shall not be established unless an agreement is executed which will assure the historical integrity of the site and until such lands as are needed for the historic site are donated for this purpose; Springfield Armory National Historic Site, Mass. 16 USC 461 note.

Tuskegee Institute National Historic Site, Ala. 16 USC 461 note.

(5) for establishment as the Tuskegee Institute National Historic Site, Alabamba, those lands depicted on the map entitled "Boundary Map, Tuskegee Institute National Historic Site, Alabama", numbered NHS-TI 20.000-C and dated September 1973, which shall include the home of Booker T. Washington, the Carver Museum, and an antebellum property adjacent to the campus of Tuskegee Institute, known as Grey Columns; and

Martin Van Buren National Historic Site, N. Y. 16 USC 461 note.

(6) for establishment as the Martin Van Buren National Historic Site, New York, those lands depicted on the map entitled "Boundary Map, Martin Van Buren National Historic Site, New York", numbered NHS-MAVA-91.001 and dated January 1974, which shall include the home of Martin Van Buren, eighth President of the United States.

Personal property, acquisition.

(b) The Secretary may also acquire personal property associated with the areas referred to in subsection (a) of this section. Lands and interests therein owned by a State or any political subdivision thereof which are acquired for the purposes of subsection (a) of this section may be acquired only by donation.

Notice to congressional committees.

SEC. 102. (a) When the Secretary determines that an adequate interest in lands has been acquired to constitute an administrable unit for each of the areas described in section 1 of this Act, he may, after notifying the Committees on Interior and Insular Affairs of the United States Congress of his intention to do so at least fourteen days in advance, declare the establishment of such unit by publication of a notice to that effect in the Federal Register. Such notice shall contain a map or other description of the boundaries of the unit, together with an explanation of the interests acquired and the costs incident thereto. The Secretary may refrain from acquiring property for establishment of any unit authorized by this Act where, in his judgment, satisfactory agreements or donations with respect to properties which are needed for the protection and administration of a particular unit have not been consummated with the owners of such properties.

Publication in Federal Register.

Administration.

(b) Pending the establishment of each unit and, thereafter, the Secretary shall administer the property acquired pursuant to this Act in accordance with the provisions of the Act of August 25, 1916 (39 Stat. 535), as amended and supplemented, and, to the extent applicable, the provisions of the Act of August 21, 1935 (49 Stat. 666), as amended.

16 USC 1. 16 USC 461.

Tuskegee Institute National Historic Site, road construction.

SEC. 103. Notwithstanding any other provision of law, the Secretary is authorized to construct roads on real property in non-Federal ownership within the boundaries of the Tuskegee Institute National Historic Site. Any roads so constructed shall be controlled and maintained by the owners of the real property.

Appropriation.

SEC. 104. There are authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act, not to exceed, however, the following:

(a) Clara Barton National Historic Site, $812,000 for acquisition of lands and interests in lands and for development;

(b) John Day Fossil Beds National Monument, $400,000 for the acquisition of lands and interests in lands and $4,435,200 for development;

(c) Knife River Indian Villages National Historic Site, $600,000 for the acquisition of lands and interests in lands and $2,068,000 for development;

(d) Springfield Armory National Historic Site, $5,300,000 for development;

(e) Tuskegee Institute National Historic Site, $185,000 for the acquisition of lands and interests in lands and $2,722,000 for development; and

(f) Martin Van Buren National Historic Site, $213,000 for acquisition of lands and interests in lands and $2,737,000 for development.

TITLE II

SEC. 201. In order to preserve for the benefit and inspiration of the people of the United States as a national historic site, the Sewall-Belmont House within the District of Columbia, the Secretary of the Interior is authorized to enter into a cooperative agreement to assist in the preservation and interpretation of such house. Sewall-Belmont House National Historic Site, D. C.

SEC. 202. The property subject to cooperative agreement pursuant to section 101 of this Act is hereby designated as the "Sewall-Belmont House National Historic Site". 16 USC 461 note.

SEC. 203. The cooperative agreement shall contain, but shall not be limited to, provisions that the Secretary, through the National Park Service, shall have right of access at all reasonable times to all public portions of the property covered by such agreement for the purpose of conducting visitors through such property and interpreting it to the public, that no changes or alterations shall be made in such property except by mutual agreement between the Secretary and the other parties to such agreement. The agreement may contain specific provisions which outline in detail the extent of the participation by the Secretary in the restoration, preservation, and maintenance of the historic site. Cooperative agreement.

SEC. 204. There are hereby authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act, but not to exceed $500,000. Appropriation.

Approved October 26, 1974.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 93-1285 (Comm. on Interior and Insular Affairs)
SENATE REPORT No. 93-1233 (Comm. on Interior and Insular Affairs)
CONGRESSIONAL RECORD, Vol. 120 (1974):
Aug. 19, considered and passed House.
Oct. 8, considered and passed Senate, amended.
Oct. 16, House concurred in Senate amendments.

APPENDIX E

SENATE COMMITTEE REPORT

NE

Calendar No. 568

93D CONGRESS
1st Session

SENATE

REPORT
No. 93–590

SPRINGFIELD ARMORY NATIONAL HISTORIC SITE, MASS.

DECEMBER 3, 1973.—Ordered to be printed

Mr. BIBLE, from the Committee on Interior and Insular Affairs, submitted the following

REPORT

[To accompany S. 979]

The Committee on Interior and Insular affairs, to which was referred the bill (S. 979) to authorize the establishment of the Springfield Armory National Historic Site, Massachusetts, and for other purposes, having considered the same, reports favorably thereon with an amendment and recommends that the bill as amended do pass.

An open hearing was held on S. 979 by the Parks and Recreation Subcommittee on November 6, 1973.

PURPOSE OF BILL

The purpose of S. 979, as amended, is to provide for the preservation and management of the Springfield Armory as a National Historic Site for the inspiration and enjoyment of the American people. The Armory has already been determined to be nationally significant and is a Registered National Historic Landmark.

The proposal includes:

1. Acquisition by donation from the City of Springfield of the Main Armory, Commanding Officer's Quarters and sufficient land for supporting services, setting and buffer; acquisition of the Master Armorer's Quarters, other historic structures worthy of preservation, and a strip of land to the southeast and northeast of the Main Armory from the Commonwealth of Massachusetts.
2. Scenic controls covering the Parade and the exterior of the historic structures presently surrounding it, on the northeast and southeast side. This applies to land owned by the Commonwealth.
3. Access right-of-way through Commonwealth property.
4. Assurance of continuing presence of the arms collection owned by the Department of the Army.

99–010

DETAILED DESCRIPTION

The city-owned land, approximately 18.85 acres, contains two of the major buildings—the Main Armory and the Commanding Officer's Quarters—and the original sites of the Master Armorer's Quarters and the Paymaster's Quarters.

The structures are needed to display the world famous weapons collection, interpret the history of the Springfield Armory, and to accommodate the various needs and interests of the visiting public, weapons enthusiasts, scholars, and researchers who will make use of the proposed National Historic Site. Examples of such uses include study areas, library, curatorial offices, display rooms, settings for special events, and the like.

Acquisition of the city-owned grounds will make it possible to preserve the distinct identity and individuality of historic Armory Square, specifically those grounds at the rear of the Main Armory and the Commanding Officer's Quarters. Fee acquisition of a small strip of land owned by the Commonwealth is needed to provide continuity and unity of the historic scene in the southern portion of Armory Square. Visually, this strip is a part of the city-owned property; however, it is owned by the Commonwealth.

Subject to an agreement with the Commonwealth certain historic structures owned by them will possibly be relocated within the National Historic Site. The Master Armorer's Quarters will be relocated to its original location beside the main arsenal building. In addition other buildings of architectural importance will be considered for possible relocation within the proposed park boundaries. These buildings are presently located within the area to the northwest of the parade field and if not relocated will be demolished during the construction of the modern campus of the Springfield Technical Community College. Relocating the Master Armorer's Quarters will add to the integrity of the historic site and along with the other structures, in addition to the main arsenal, will be needed for administrative, study, classrooms, tour staging, special events, meetings, and maintenance workshop.

The proposal includes a recommendation for scenic and developmental control over the Parade and the facade of the historic buildings facing the Parade on the northeast and southeast side. These buildings along with the parade field will continue in the ownership of the Commonwealth and will be managed directly by the Springfield Technical Community College. The scenic and developmental controls are necessary to insure the preservation of the historic setting and the environment of the proposed National Historic Site. The buildings on the northwest side of the Parade, part of the modern college development, are already under construction and will be of a contemporary and massive scale.

The proposed right-of-way through Commonwealth property is to provide an entrance to the National Historic Site from Federal Street.

Assurance of the continuing presence of the arms collection owned by the Department of the Army is proposed, since it is an inseparable part of the story of the Springfield Armory. It will form the basis of interpretation, augmented by displays and audio-visual techniques.

A total of 54.923 acres is proposed for inclusion within the site of which 20.317 acres would be donated to the Federal Government and 34.606 acres would be preserved by the State of Massachusetts. Visitation is expected to be approximately 28,000 the first year and grow to approximately 52,000. The Department proposes to charge a 50-cent admission charge.

The Advisory Board on National Parks, Historic Sites, Buildings, and Monuments endorsed this proposal in its 65th meeting, October 4-6, 1971.

COSTS AND COMMITTEE AMENDMENTS

Because the land would be acquired entirely through donation, no land acquisition costs are involved.

Total development costs are expected to be about $5,365,000 over a five-year period with operational costs estimated at about $355,000 a year. The Committee amended S. 979 to limit the amount authorized for development to the amount stated above.

COMMITTEE RECOMMENDATIONS

The Committee on Interior and Insular Affairs in executive session on November 27, 1973, unanimously recommended enactment of S. 979, as amended.

DEPARTMENTAL REPORTS

The reports of the Department of the Interior, the Office of Management and Budget and the Department of the Army are set forth in full as follows:

U.S. DEPARTMENT OF THE INTERIOR,
OFFICE OF THE SECRETARY,
Washington, D.C., August 31, 1973.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs, U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Your Committee has requested the views of this Department on S. 979, a bill "To authorize the establishment of the Springfield Armory National Historic Site, Massachusetts, and for other purposes."

We recommend the enactment of the bill.

The bill authorizes the Secretary of the Interior to acquire by donation such real or personal property at the historic Springfield Armory in Springfield, Massachusetts, as is adequate in his judgment to constitute an administrable unit. The Secretary is to establish the Springfield Armory National Historic Site when he has accepted the donated property and has reached satisfactory agreements (1) with the Commonwealth of Massachusetts or state agency or instrumentality for preservation of Springfield Armory lands and buildings that are not in Federal ownership, and (2) with the Secretary of the Army for retention or transfer of the arms collection and other museum objects located at the armory. The area is to be administered by the Secretary in accordance with the Act of August 25, 1916 (39 Stat. 535; 16 U.S.C. 1, 2-4), and the Act of August 21, 1935 (49 Stat. 666; 16 U.S.C. 461 *et seq.*).

Springfield is Massachusetts' third largest city, with 163,905 inhabitants in 1970. It is located in the western part of the State not far north of Connecticut. Interstate Highway 90 runs in an east-west alignment just north of the city. For nearly 200 years, the armory has been the heart of the Springfield area. From its inception, the operating center of Springfield Armory has been Armory Square, which lies above the center city and the Connecticut River. The Armory Square complex contains a tree-covered parade and various historic buildings once used for housing, administration, manufacturing, and storage at the armory. Since 1968, when the armory was deactivated, many of these buildings have been used in conjunction with Springfield Technical Community College.

The proposed national historic site would include three major Arsenal buildings: the commanding officer's quarters, the master armorer's quarters, and the main arsenal. The main arsenal houses the Springfield Armory Museum, which contains the outstanding Benton Arms Collection as well as other exhibits. The arms collection includes not only the products of Springfield Armory but also firearms that illustrate the growth of the entire American arms industry.

Armory Square has retained its identity and overall architectural composition for the past 100 years. The square's size and distinction, provided in part by its elevation and the iron fence enclosing it, provide a degree of isolation from the adjacent urban environment. Within walking distance of the proposed national historic site is the quadrangle that is considered the cultural heart of Springfield.

The proposed Springfield Armory National Historic Site would commemorate the important role of the Springfield Armory in the Nation's military history. For nearly 200 years, the armory was a center for manufacturing and development of small arms, producing weapons which achieved a justified reputation for quality, accuracy, and dependability. For a substantial portion of this time, the armory made Springfield the small arms center of the world. The site's history began in 1777, when Armory Square in Springfield was selected as the location for a magazine and laboratory for the development, production, and storage of guns and powder. During the American Revolution, Armory Square was the site of important ordnance manufacturing and storage facilities; it served as a supply depot for the entire northern theater of war. Following the Revolutionary War, in 1794, Congress officially established the Springfield Armory. During the latter half of the 19th century, from the time of the destruction of the Harpers Ferry installation in 1861, until the Rock Island Arsenal began some production of rifles in 1904, the Springfield Armory was the sole supplier of military small arms manufactured by the U.S. Government. Most of the United States Armed Services small arms were developed in the laboratories at Springfield Armory until the time that the armory was deactivated as a military installation, in April 1968.

In addition to its historical role in the development and manufacturing of small arms, Springfield Armory was also the site where Shay's Rebellion was quelled. On January 25, 1787, the rebellion of small farmers under Daniel Shays against alleged unfair taxation ended at

Springfield Arsenal, with their defeat as they attempted to seize the magazine.

The Department believes that Springfield Armory represents a heritage of Government arms development and manufacture that is worthy of preservation. In April 1963, the Armory was dedicated as a National Historic Landmark. And at its 65th meeting in October 1971, the Secretary's Advisory Board on National Parks, Historic Sites, Buildings, and Monuments "heartily endorse[d] the establishment of the Armory Square portion of the Springfield Armory as the Springfield Armory National Historic Site."

After deactivation in 1968, part of Armory Square was conveyed to the city of Springfield, which in turn leased a portion to Springfield Armory Museum, Inc., a nonprofit foundation, for preservation and management. Other parts of the Armory were conveyed to the Commonwealth of Massachusetts. It became apparent, however, that preservation of the appearance of historic buildings, particularly those marked for use by the Springfield Technical Community College, was not assured. Furthermore, the foundation which managed the arms collection encountered funding difficulties; subsequent to unsuccessful national fund-raising attempts, its management asked that the National Park Service preserve and manage the armory as a national historic site.

Springfield Armory National Historic Site would encompass approximately 55 acres. The Department proposes to acquire in fee, through donation, 18.35 acres of land owned by the city of Springfield and a strip of 1.97 acres owned by the State of Massachusetts and utilized in conjunction with the college. The remaining 34.61 acres would remain in State ownership, constituting a "Preservation Control Area", pursuant to an agreement to be concluded with the State, that would preserve the historic appearance of the parade and the exterior of structures, including the Technical College, surrounding it. In addition, the Department would conclude an agreement with the Secretary of the Army concerning the arms collection and other museum objects now at the site. Since the arms collection is a key feature of the historic site, the Department believes that a satisfactory agreement should include a loan of the articles on a long-term basis, subject to renewal, to the National Park Service. A draft of an agreement containing this type of loan arrangement has been negotiated; its signing awaits the passage of legislation creating the historic site.

Because land would be acquired entirely through donation, no land acquisition costs are involved. The estimated cost of operation and maintenance is expected to be about $356,000 per year. A staff of 14 permanent and two seasonal man-years of personnel is contemplated.

Restoration of the buildings included in the proposed national historic site would be necessary and we propose undertaking development of interpretive exhibits in the main arsenal. Development costs are estimated to be about $5.3 million, based on February 1973 prices. Of this amount, $3 million is programmed for development of interpretive exhibits in the main arsenal, and about $2.3 million is for buildings, restoration, and grounds work. The $3 million for development of the interpretive exhibits includes a complete cataloguing of the arms collection and preservation or restoration as needed.

A man-years and cost data statement is enclosed.

The Office of Management and Budget has advised that there is no objection to the presentation of this report from the standpoint of the Administration's program.

Sincerely yours,

DOUGLAS P. WHEELER,
Acting Assistant Secretary of the Interior.

Enclosure.

U.S. DEPARTMENT OF THE INTERIOR, NATIONAL PARK SERVICE—SPRINGFIELD ARMORY NATIONAL HISTORIC SITE

	19CY	19CY+1	19CY+2	19CY+3	19CY+4
Estimated additional expenditures:					
Personnel services	$194,000	$206,000	$206,000	$206,000	$205,000
All other	722,000	1,195,000	1,505,000	1,830,000	820,000
Total	916,000	1,401,000	1,711,000	2,035,000	1,025,000
Estimated additional obligations:					
Land and property acquisition					
Developments	559,000	1,043,000	1,353,000	1,740,000	670,000
Operations (management, protection, and maintenance, planning, development, and operation of reclamation facilities)	357,000	358,000	357,000	355,000	355,000
Total	916,000	1,401,000	1,710,000	2,095,000	1,025,000
Total, estimated expenditures: Man-years of civilian employment	15	16	16	16	16

DEPARTMENT OF THE ARMY,
Washington, D.C., October 19, 1973.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs,
U.S. Senate, Washington, D.C.

DEAR MR. CHAIRMAN: Reference is made to your request for the views of the Department of Defense on S. 979, 93d Congress, a bill "To authorize the establishment of the Springfield Armory National Historic Site, Massachusetts, and for other purposes."

The purpose of the bill is to provide authority to establish the Springfield Armory National Historic Site. It also would provide authority for the Secretary of the Interior to negotiate with the Commonwealth of Massachusetts and the City of Springfield for the use of land not in Federal ownership which comprised part of the Springfield Armory, and with the Secretary of the Army for the use of the Springfield Armory Museum Collection, housed at the Springfield Armory.

The Department of the Army, on behalf of the Department of Defense, favors the bill. This collection is of great historical value and without parallel in the United States. Springfield, historically the center of America's small arms production and development, is the logical home for the collection. It is felt that retention of the collection at Springfield will commemorate the Armory's contribution to the Nation throughout its history.

For the foregoing reasons, the Department of the Army on behalf of the Department of Defense, recommends that the bill be favorably considered.

The enactment of this bill will cause no apparent increase in budgetary requirements of the Department of Defense.

This report has been coordinated with the Department of Defense in accordance with procedures prescribed by the Secretary of Defense.

The Office of Management and Budget advises that, from the standpoint of the Administration's program, there is no objection to the presentation of this report for the consideration of the Committee.

Sincerely,

HERMAN R. STAUDT,
Acting Secretary of the Army.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF MANAGEMENT AND BUDGET,
Washington, D.C., September 7, 1973.

Hon. HENRY M. JACKSON,
Chairman, Committee on Interior and Insular Affairs, U.S. Senate, New Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: This is in response to your request of May 24, 1973, for the views of the Office of Management and Budget on S. 979, a bill "To authorize the establishment of the Springfield Armory National Historic Site, Massachusetts, and for other purposes."

The Office of Management and Budget concurs in the views of the Department of the Interior in its report on S. 979, and accordingly recommends enactment of the bill.

Sincerely,

WILFRED H. ROMMEL,
Assistant Director for Legislative Reference.

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APPENDIX F

COOPERATIVE AGREEMENT BETWEEN UNITED STATES AND THE COMMONWEALTH OF MASSACHUSETTS

AGREEMENT BETWEEN THE UNITED STATES OF AMERICA
AND THE COMMONWEALTH OF MASSACHUSETTS

THIS AGREEMENT, made and entered into this 27th day of March, 1978, between the United States of America, acting by and through the Secretary of the Interior by the Regional Director, North Atlantic Region, National Park Service (hereinafter referred to as the "Service") and the Commonwealth of Massachusetts, acting by and through the President, Massachusetts Board of Regional Community Colleges (hereinafter referred to as the "Board").

WITNESSETH:

WHEREAS, the Springfield Armory in Springfield, Massachusetts has played an important role in the military and industrial history of the Nation; and

WHEREAS, it is a national policy to preserve for public use historic sites, buildings and objects of national significance and benefit to the people of the United States; and

WHEREAS, in furtherance of that policy and pursuant to the provisions of the Act of October 26, 1974, 88 Stat. 1461, the Secretary of the Interior is authorized to establish as a unit of the National Park System, the Springfield Armory National Historic Site, Massachusetts (hereinafter referred to as the "national historic site"); and

WHEREAS, a portion of the authorized national historic site is owned by the Commonwealth of Massachusetts and administered by the Board through and as a part of the Springfield Technical Community College (hereinafter referred to as the "College"), and will remain in commonwealth ownership; and

WHEREAS, the Service recognizes the Board's interest in the continued use of its portion of the national historic site for educational purposes, and the Board recognizes the Service's interest in the preservation of the Springfield Armory, its parade ground and historic structures, for public benefit and inspiration, and both are endeavoring to balance and accommodate these interests; and

WHEREAS, the Act of October 26, 1974, supra, provides that the national historic site shall not be established unless an agreement is executed which will assure the historical integrity of the site and until such lands as are needed for the national historic site are donated for that purpose;

NOW, THEREFORE, in consideration of and pursuant to the provisions of section 101 (a) (4) of the Act of October 26, 1974, supra, the Historic Sites Act of 1935, 49 Stat. 666, 16 U.S.C. §§ 461-467 (1970), and section 2 of the Act of August 18, 1970, 84 Stat. 826, amending the Act of August 8, 1953, 67 Stat. 496, 16 U.S.C. § 1c (1970), the Service and the Board do mutually convenant and agree as follows:

ARTICLE I. The Service and the Board mutually agree that the authorized national historic site comprises an area bounded on the north by Pearl Street, on the east by Federal Street, on the south by State Street and on the west by Byers Street, and contains 55 acres, more or less, as depicted on the map entitled "Boundary Map, Springfield Armory National Historic Site, Springfield, Massachusetts," which is attached to and made a part of this agreement as Attachment A. It is intended that the area comprising the national historic site shall consist of two parts, with one part under the administrative jurisdiction of the Service and the other part under the administrative jurisdiction of the Board. It is intended that the part to be under the Service's jurisdiction shall consist of 1) approximately 18.35 acres of land owned by the City of Springfield, which is to be conveyed and donated in fee by the City to the United States and 2) a strip of land containing approximately 1.97 acres designated as Parcel A and a strip of land of approximately the same acreage designated as Parcel B on the map attached hereto as Attachment B, owned by the Commonwealth of Massachusetts and utilized in conjunction with the College, which are to be conveyed and donated to the United States in accordance with Article II, paragraph f, of this agreement. The part under the Board's jurisdiction shall consist of approximately 34.61 acres of land, which will remain in commonwealth ownership, and shall constitute a "Preservation Control Area," wherein the Board, in cooperation with the Service and other appropriate federal and commonwealth agencies, will preserve the appearance of the exterior of the historic structures and of the historic Springfield Armory parade ground (hereinafter referred to as the "parade ground"). Wherever it appears in this agreement, the term "historic structures" shall mean those structures identified on the National Register of Historic Places Nomination Form, completed 12/2/74, by the Service's Historic Site survey as "major elements in the Armory Square Complex" including, but not limited to, Building 27 identified therein. The Service and the Board agree that it is the intent and purpose of this agreement to provide for the Board's administration of the Preservation Control Area and preservation of the historical integrity of that portion of the national historic site included therein. The boundaries of the Preservation Control Area are those depicted on the map attached to and made a part of this agreement as Attachment C.

ARTICLE II. The Board for itself, its subsidiaries, its successors, and its assigns agrees:

a. That the Preservation Control Area will be open to the public in accordance with a time schedule mutually agreed upon by the Board and the Service.

b. That in accordance with the Act of October 26, 1974, supra, authorizing the establishment of the national historic site, and its legislative history, including and consistent with the exceptions expressed therein (See Hearings on H.R. 329 before the Subcomm. on National Parks and Recreation of the House Comm. on Interior and Insular Affairs, 93d Cong. 1st Sess. (1973), appended as Attachment D.), it will undertake 1) no construction, alteration, or repair that will change the historical integrity, including but not limited to the qualities of scale, mass, design, spacial arrangement, detail and character, of the parade ground or of the exterior of the historic structures that front upon it, and 2) no construction, alteration, or repair that will change the historic appearance of the exterior of any of the other historic structures within the Preservation Control Area. Any construction, alteration, or repair proposed by the Board within the Preservation Control Area will be subject to the concurrence of the Service following review of its impact on the parade ground and to the terms contained in, or as may hereinafter be added to or amended in, the deed between the United States of America acting by and through the Secretary of Health, Education, and Welfare, and the Commonwealth of Massachusetts, acting by and through the President, Massachusetts Board of Regional Community Colleges, executed April 26, 1968, conveying to the commonwealth the lands constituting the Preservation Control Area, supra, and the structures therein. As a part of this review process, the Service will base its concurrence in the construction or alteration of structures behind the buildings immediately fronting on the northwest side of the parade ground on an elevation that does not exceed, when viewed from any point within the parade ground and from the lands immediately adjacent to its southwestern side, the height of the buildings that front immediately on the northwest side. The Service shall have 45 days from the receipt of a proposal for construction, alteration, or repair in which to notify the Board of its concurrence or non-concurrence in such proposal or such additional time as is needed to complete any procedures required by 36 CFR, Part 800, the regulations implementing Section 106 of the National Historic Preservation Act of 1966. If additional time is required the Service will notify the Board within the previously identified 45 days of the need for additional time. The Service shall use its best effort to complete any procedures which the Service is required to perform in complying with the requirements of 36 CFR Part 800. It is the intent of the parties to this agreement that the terms and promises contained in this paragraph shall apply only to the shaded area depicted on the map attached hereto as Attachment C.

c. That it will sponsor or permit no use of the Preservation Control Area that is inconsistent with the preservation of its historic structures and the parade ground and their setting and visual integrity, and with public visitation to and enjoyment of the area. Prior to sponsoring or permitting any major, unordinary, or novel use of the Preservation Control Area, the Board will give the Service 3 days notice.

d. That it will retain Building 10 (commonly known as the Master Armorer's Quarters) until July 1, 1979, in order to afford the Service the opportunity to remove and relocate the building to a site within the national historic site outside the Preservation Control Area. Thereafter, should the Board consider demolition of Building 10 as necessary for its development program, the Board shall 1) give the Service advance notice of its intent to demolish the building as far in advance as possible, but at least 180 days before commencing demolition; and 2) fulfill any requirements in or hereinafter made by amendment in or addendum to the deed between the United States of America and the Commonwealth of Massachusetts, executed April 26, 1968, supra, prior to commencing demolition.

e. That it shall administer the area under its jurisdiction in such a manner as to ensure that all visitors to the national historic site shall be guaranteed the protection of all rights established under the Constitution of the United States.

f. That it shall, subject to a written release by the United States Department of Health, Education and Welfare of the restrictions contained in the deed between the United States of America and the Commonwealth of Massachusetts, executed April 26, 1968, supra, which release shall be conditioned upon Parcels A and B, supra, being conveyed and donated by the Commonwealth of Massachusetts to the United States for the purpose of the Act of October 26, 1974, supra, and the concurrence of any other appropriate federal agencies, and subject to the enactment and approval of any necessary commonwealth enabling legislation, convey and donate in fee simple to the United States acting by and through the Service, Parcel A and Parcel B, as described and depicted in Attachment B, for access purposes, as hereinafter more fully described in Article III, paragraph a, of this agreement. The Board will initiate immediate action to have the legislature of the Commonwealth of Massachusetts pass any legislation necessary to convey and donate Parcel A and Parcel B to the United States. This action will not hinder putting this agreement into effect.

g. That the duly authorized representatives of the United States Department of the Interior and the Service shall have access to the Preservation Control Area and the historic structures therein at all reasonable times for the purpose of inspecting to ensure compliance with the provisions of this agreement.

h. That it will cooperate with the Service and other appropriate agencies in fulfilling any requirements necessary for compliance with section 106 of the National Historic Preservation Act of 1966, 80 Stat. 917, 16 U.S.C. § 470f (1970), as those requirements apply to any structures, lands, or historic qualities within the Preservation Control Area.

ARTICLE III. The Service agrees, subject to the availability of appropriated funds, as follows:

a. That the donation of Parcel B for access purposes shall be subject to the condition that the road constructed on said Parcel B will be closed, in accordance with the provisions discussed below, to all vehicular traffic except administrative, maintenance and emergency vehicles of the Service and its contractors, and that the Commonwealth of Massachusetts may reserve in its deed of donation a perpetual easement and right-of-way to the Board for the use of its administrative, maintenance and emergency vehicles, and those of its contractors. The Service agrees to allow the road through Parcel B to remain open for use by the general public until December 31, 1980, so that the Board can study traffic circulation in the vicinity of the parade ground and devise another pattern of traffic flow. If the Board can accomplish a mutually acceptable revised traffic circulation system before December 31, 1980, the road may be closed for such public use at an earlier date to open the way for a more timely restoration of the historic scene. If the Board has not so revised the traffic and circulation system by December 31, 1980, the Service may provide advice and technical assistance to accomplish the above and may permit the road through Parcel B to remain open for use by the general public for such period as is necessary to revise such system, which period shall not exceed five calendar years.

b. That it will cooperate with the Board in the preservation of the Preservation Control Area by providing technical advice and assistance and will cooperate with the Board in all appropriate and mutually agreeable ways in accomplishing the purposes of the national historic site.

c. That it will join with the Board in seeking a common solution to the need for student, staff, and national historic site visitor parking, including consideration of a parking structure designed to conform with the requirements and intent of Article II, paragraph b, of this agreement.

d. That it will consider entering, subject to federal procurement statutes and regulations, into a supplemental agreement with the Board or the College relating to the payment by the Service of its fair share of the costs of utility service furnished by the Board or the College to those structures situated in the federally owned portion of the national historic site. Such fair share may include costs of maintenance and repair of that portion of the utility system situated within the federally owned portion of the national historic site.

e. That it will enter into discussions with the Board or the College regarding a mutually satisfactory agreement whereby the Service will purchase, subject to federal procurement statutes and regulations, from either the Board or the College maintenance service for the federally owned lands within the national historic site, including such services as seeding and mowing the lawn, trees, shrub and plant care, and snow removal.

ARTICLE IV. Subject to the availability of appropriated funds, the Service and the Board will be responsible for maintaining the historic iron fence within their respective portions of the national historic site and will determine cooperatively standards and guidelines appropriate for treatment of the historic fabric of the fence by which both will perform their maintenance.

ARTICLE V. No member of, or delegate to Congress or Resident Commissioner, shall be admitted to any share or part of this agreement or to any benefit that may arise therefrom, but this restriction will not be construed to extend to this agreement if made with a corporation or company for its general benefit.

ARTICLE VI. The Board will comply with Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. § 2000d-2000d-4 (1970) and the regulations issued pursuant thereto, and Executive Order No. 11246, September 24, 1965, 30 F. R. 12319, as amended, and the regulations issued pursuant thereto.

ARTICLE VII. As the promises and obligations contained herein are peculiar and unique, and, further, are not susceptible to monetary valuation, the Service may, in the event by the Board of a breach of any of the terms and conditions herein, bring an action for specific performance thereof.

ARTICLE VIII. This agreement shall continue in force and in effect indefinitely unless terminated 1) by one year's written notice by either party or 2) by mutual consent. In the event of termination, both parties shall cooperate in fulfilling any requirements necessary for compliance with section 106 of the National Historic Preservation Act of 1966, supra.

IN WITNESS WHEREOF, on the 27th day of March, 1978, at ________________, the parties hereto have caused this agreement to be signed, sealed, and delivered by their duly authorized officers respectively.

Signed, sealed, and delivered in the presence of:

Robert Chertz

United States of America
Acting by and through the
Secretary of the Interior

By Jack E. Stark
Regional Director
North Atlantic Region
National Park Service

Commonwealth of Massachusetts
Acting by and through the
President, Massachusetts
Board of Regional
Community Colleges

By John V. Costello

____

Approved as to form and authority:

____

Attorney General
Commonwealth of Massachusetts

APPENDIX G

COOPERATIVE AGREEMENT BETWEEN THE DEPARTMENT OF THE ARMY AND THE DEPARTMENT OF THE INTERIOR

COOPERATIVE AGREEMENT

Between

DEPARTMENT OF THE ARMY

and

DEPARTMENT OF THE INTERIOR

WHEREAS, P.L. 93-486, 88 Stat. 1461, authorizes the Secretary of the Interior to establish the Springfield Armory National Historic Site; and

WHEREAS, the Springfield Armory, commissioned by President Washington in 1794, was the site of Shays' Rebellion (1786-1787) and, until deactivated in 1968, the oldest manufacturing arsenal in the United States; and

WHEREAS, the Springfield Armory Collection which is owned by the United States and in the custody of the Department of the Army, has special relevance to the historical significance of the Springfield Armory; and

WHEREAS, the Department of the Army is authorized by P.L. 93-486, 88 Stat. 1461, and the Economy Act of June 30, 1932, 47 Stat. 417, 31 U.S.C. § 686 (1970) to utilize the services of the Department of the Interior in preserving and displaying the Springfield Armory Collection; and

WHEREAS, transfer on loan of the Springfield Armory Collection, which is deposited by the Department of the Army at the Springfield Armory Museum, for continued preservation and display at the Springfield Armory National Historic Site is in the best interest of military history, the Department of the Army and the Department of the Interior;

NOW, THEREFORE, in consideration of the promises to be performed by the parties hereto and of the mutual agreement contained herein, it is agreed as follows:

1. The effective date of this agreement is the signature date, Secretary of Army.

2. The Department of the Army (hereinafter the Army) agrees to lend to the Department of the Interior (hereinafter the Department) the Springfield Armory Collection, deposited at the Springfield Armory Museum, as jointly inventoried by the Army and the National Park Service and recorded in the Springfield Armory Museum Historical Properties Book, maintained at the Springfield Armory National Historic Site, and all provenience records and additional cataloguing information (hereinafter the property) for preservation and display at the Springfield Armory National Historic Site for a period of ten (10) years.

3. This agreement shall be renewed automatically at the end of ten (10) years for periods of like duration unless either party gives written notice, ninety days prior to expiration of each 10-year period, of the other party's non-compliance with the conditions of this agreement.

4. Ninety days prior to the expiration of each 10-year period, the Army and the Department may meet to consider modification of those specific terms of the agreement concerning the administration of the property.

5. The Army will from time to time improve the property by making additions to it that clearly conform to a defined scope of the collection to be agreed upon by both parties. Offers of specimens for this collection from other agencies, organizations, or individuals will be referred to the Army for approval. No items in the collection will be de-accessioned by the Department without prior approval of the Army.

6. The Army may make reasonable withdrawals of items from the property for purposes of temporary loan to Department of Defense installations,

private organizations and contractors. A reasonable withdrawal is a withdrawal which does not destroy the historical significance, integrity or unity of the Springfield Armory National Historic Site, nor pose an undue threat to the preservation of individual items. Prior to the withdrawal of any item of the property, the Army shall give the Department five days notice; except that in the case of the withdrawal of any item on permanent public display, the Army shall give the Department 30 days notice. The Department should be responsible for the packaging and shipping of items of the property withdrawn for purposes of temporary loan to Department of Defense installations and contractors. The Army will be responsible for packaging and shipping to return items withdrawn on temporary loan from Springfield.

7. The Department shall have curatorial responsibility for the care and display of the property and shall prepare a program of maintenance, storage, restoration, and display of the property.

8. The Department shall permit the on-site study of the property by students, scholars, and representatives of museums, colleges, governmental agencies, or other institutions and organizations under prescribed rules and regulations, which will be published in the Code of Federal Regulations.

9. The Department may lend an item of the property to any other agency of the Federal Government for up to six months without prior approval of the Army. The Department may lend any item of the property to any agency, organization, or individual outside the Federal Government only upon the prior approval of the Army.

10. It is the intent of the parties to this agreement that if the Department determines that an item of the property has specific historical relevance to a National Park System installation other than the Springfield Armory

National Historic Site, the Department may transfer the item to that installation, providing the Army with a copy of the transfer document describing the item(s) transferred and location.

11. Copies of all provenience records and additional information appropriate for accessioning and cataloguing individual specimens will be maintained in a permanent records file, according to the standard museum records practice of the National Park Service.

12. The property shall be available for inspection and inventory by the Army at any reasonable time.

13. The Secretary of the Interior shall specify measures to be taken for the physical security of the property which are consistent with the standards prescribed by Army Regulation 190-18 (July 19, 1967) or established through negotiation as acceptable substitutions thereof.

Clifford L. Alexander, Jr.
Clifford L. Alexander, Jr.
Secretary of the Army

(Date) 15 DEC 1978

Cecil D. Andrus
Cecil D. Andrus
Secretary of the Interior

(Date) OCT 2 6 1978

APPENDIX H

ASBESTOS TESTING

During the preparation of contract documents test for asbestos content were run on samples on insulation in Building 1 and a dropped ceiling in Building 18. Tests were performed by the Commonwealth of Massachusetts, Department of Labor and Industries, Division of Occupational Hygiene. Blind samples were submitted and sample numbers and locations are listed below for use with the results.

Sample	Location
1	Steam pipe above new boiler pad
2	Steam pipe to heating chamber No. 1 next to existing hot water heater
3	Air duct out of heating chamber No. 2
4	Air duct ceiling of tool room from heating chamber No. 3
5	Ceiling (drop) of Building 18.

The Commonwealth of Massachusetts
Executive Office of Economic Affairs
Department of Labor and Industries
Division of Occupational Hygiene
39 Boylston Street, Boston 02116

WILLIAM M. SHIPPS
Commissioner

In Your Reply
Refer to File
81-595

April 27, 1981

Mr. Joe Wadland
Springfield Armory National Historical Site
One Armory Square
Springfield, MA 01105

Dear Mr. Wadland,

The bulk samples that you sent to the Division of Occupational Hygiene on April 6, 1981 have been analyzed for asbestos. No locations were given of where the samples were taken.

The samples were analyzed using phase contrast microscopy and polarized light microscopy with dispersion staining.

The results are as follows:

Sample	Analysis No.	Result	% Composition
1	6369	amosite asbestos	10-25
2	6370	amosite asbestos	10-25
3	6371	chrysotile asbestos	25-50
4	6372	chrysotile asbestos	25-50
5	6373	non-asbestos	-

In summary, samples 1-4 contain significant amounts of asbestos, and appropriate precautions should be taken during the removal process.

Yours very truly,

Richard Grillo

Richard Grillo
Chemist

A-7615

Approved:

Harold Bavley

Harold Bavley, P. E.
DIRECTOR

RG/mas

APPENDIX I

PROJECT ESTIMATES AND 10-802

FORM 802 and CONSTRUCTION ESTIMATE

The most recent Form 802, Package Estimating Detail, dated October 24, 1979, is included in this appendix. This form projected a specific strategy for phasing of construction, with FY 1982 being the largest construction year for the Arsenal.

Significant construction has occurred since the preparation of the Form 802, some of which was included in the Phase I estimate. The $360,000 Phase I figure for Building 13 includes approximately $169,600 worth of work which has not been contracted for to date. The total figure for interior adaptive use of Building 13 escalated to FY 84 figures which would be $3,425,788.

In June 1982, prior to entering the comprehensive design stage for the adaptive use of Building 13, the Denver Service Center re-estimated the work. The new estimate was based on a slightly more detailed knowledge of proposed functional uses for Building 13, and is also included in this estimate. This estimate totaled $2,907,490 for FY 84 which is approximately 15 percent less than the previous estimate, but generally confirms the Form 802 estimate. Therefore, the existing Form 802 can be used with reasonable confidence for programming unless significant changes are made in package scope. All construction figures must be escalated to the proper year of construction. The following escalation figures were used in the estimates:

FY 81 to FY 82 - 15 percent
FY 82 to FY 84 - 24 percent
FY 84 to FY 85 - 12 percent
FY 85 to FY 86 - 12 percent

A copy of the 1984 multi-year printout is included to show the projected funding for future advanced planning and project planning which is based on current DSC Workload Analysis; and updates estimates on the back of the Form 802s.

DSC-HFC
Form 802

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

PACKAGE ESTIMATING DETAIL

REGION	PARK
NORTH ATLANTIC	SPRINGFIELD ARMORY NHS

PACKAGE NUMBER	PACKAGE TITLE
103 A	REHAB HIST STRUCTURES -- PHASE I

(If more space is needed, use plain paper and attach)

ITEM	QUANTITY	COST
BUILDINGS & UTILITIES -- FY 1980		
1. Utilities, Bldg. #1	Lump Sum	$70,000
2. Utilities, Bldg. #13	" "	360,000
PHASE I TOTAL		430,000
This estimate is valid to October 1980.		
R. Borras, 10/9/79		

SUMMARY OF CONSTRUCTION ESTIMATES

CLASS OF ESTIMATE: A ☐ Working Drawings B ☐ Preliminary Plans C ☒ Similar Facilities

Proj. Type		Totals from Above B & U	R & T
52	Museum Exhibits		XXXXX
55	Wayside Exhibits		XXXXX
62	Audio-Visual		XXXXX
89	Ruins Stabilization		XXXXX
91	Construction	$430,000	
92	Utility Contracts		XXXXX

ESTIMATES APPROVED (Signature)	(title)	(date)
Gerald D. Patten	Assistant Manager, TNE	10/24/79

POST PROFESSIONAL SERVICES ESTIMATES AND SCHEDULING ON BACK OF FORM

SCHEDULING OF DEVELOPMENT RELATED PROJECT TYPES

FY 80
Est: 430,000

DEVELOPMENT RELATED PROJECT TYPES		C-3 YEARS	C-2 YEARS	C-1 YEAR	C: YEAR OF CONSTRUCTION	Ini
	(Add on to line item)					
07	Construction Drawings B&U					
07	Construction Drawings R&T					
36	Historic Structures Const. Drawings				61,000	
43	Archeological Salvage B&U				28,000	
43	Archeological Salvage R&T					
51	Museum Exhibit Design					
55	Wayside Exhibit Design					
61	Audiovisual Design					
	(Advance Planning)					
05	Surveys					
06	Comprehensive Design (Prel. Design)					
14	Utility Negotiations					
15	Special Studies					
34	Historic Furnishings Report					
35	Historic Structures Report (HIST)					
35	Historic Structures Report (ARCHIT)				25,000	
42	Archeological Research					

DISTRIBUTION OF ESTIMATED FUNDING REQUIREMENTS BY YEARS

ALL OTHER PROJECT TYPES		1st Year	2nd Year	3rd Year	4th Year	
01	New Area Study					
02	Existing Area Study					
03	Development Concept Plan					
04	Interpretive Prospectus					
15	Special Studies (Non-Develop. Related)					
16	E.I.S.					
17	Service-wide Projects					
18	Wilderness Studies					
31	Archeological Investigations					
32	Park History Study					
33	Special History Report					
53	Museum Exhibit Operations					
54	Curatorial Services					
63	Audiovisual Maintenance					
71	Free Folder					
72	Sales Folders					
73	Books					
74	Archeological Publication					
75	Gen. Information Booklet					
76	Posters					
77	Special Publications					
	Other					
	Other					

DSC-HFC
Form 802

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

PACKAGE ESTIMATING DETAIL

REGION	PARK
NORTH ATLANTIC	SPRINGFIELD ARMORY NHS
PACKAGE NUMBER	PACKAGE TITLE
103 A	REHAB HISTORIC STRUCTURES -- PHASE II

(If more space is needed, use plain paper and attach)

ITEM	QUANTITY	COST
BUILDINGS & UTILITIES -- FISCAL YEAR 1982		
1. Utilities, Bldg. #13	Lump Sum	$1,257,000
2. Utilities, Bldg. # 1	" "	168,000
3. Interior preservation, adaptive use, Bldg. 13	" "	900,000
4. Elevator - Bldg. #13	" "	143,000
5. Conservation lab., electrical & mechanical Bldg. #13	" "	21,000
6. Security/fire protection, Bldg. #13	" "	495,000
7. Security/fire detection, Bldg. #1.	" "	70,000
PHASE II TOTAL		$3,054,000
Note: The estimate for FY 1982 includes construction items which were originally scheduled for FY 1981.		
This estimate is valid to October 1982. R. Borras, 10/9/79		

SUMMARY OF CONSTRUCTION ESTIMATES

CLASS OF ESTIMATE: A [ ] Working Drawings; B [ ] Preliminary Plans; C [X] Similar Facilities

Proj. Type		Totals from Above B & U	R & T
52	Museum Exhibits		XXXXX
55	Wayside Exhibits		XXXXX
62	Audio-Visual		XXXXX
89	Ruins Stabilization		XXXXX
91	Construction	$3,054,000	
92	Utility Contracts		XXXXX

ESTIMATES APPROVED (Signature)	(title)	(date)
[signature]	Assistant Manager, TNE	10/24/79

POST PROFESSIONAL SERVICES ESTIMATES AND SCHEDULING ON BACK OF FORM

SCHEDULING OF DEVELOPMENT RELATED PROJECT TYPES FY 82

Est. 3,054,000

DEVELOPMENT RELATED PROJECT TYPES (Add on to line item)		C-3 YEARS	C-2 YEARS	C-1 YEAR	C: YEAR OF CONSTRUCTION	In
07	Construction Drawings B&U					
07	Construction Drawings R&T					
36	Historic Structures Const. Drawings			460,000		
43	Archeological Salvage B&U			30,000		
43	Archeological Salvage R&T					
51	Museum Exhibit Design (Planning)		**	75,000[1]		
55	Wayside Exhibit Design					
61	Audiovisual Design (Planning)		**	8,000[1]		

1 Figures from HFC 802 dated 4-20-79

(Advance Planning)		C-3 YEARS	C-2 YEARS	C-1 YEAR	C: YEAR OF CONSTRUCTION	In
05	Surveys					
06	Comprehensive Design (Prel. Design)					
14	Utility Negotiations					
15	Special Studies					
34	Historic Furnishings Report					
35	Historic Structures Report (HIST)					
35	Historic Structures Report (ARCHIT)		172,000			
42	Archeological Research					

** HFC involvement required if coordination with anticipated preliminary design is to occur.

DISTRIBUTION OF ESTIMATED FUNDING REQUIREMENTS BY YEARS

ALL OTHER PROJECT TYPES		1st Year	2nd Year	3rd Year	4th Year
01	New Area Study				
02	Existing Area Study				
03	Development Concept Plan				
04	Interpretive Prospectus				
15	Special Studies (Non-Develop. Related)				
16	E.I.S.				
17	Service-wide Projects				
18	Wilderness Studies				
31	Archeological Investigations				
32	Park History Study				
33	Special History Report				
53	Museum Exhibit Operations				
54	Curatorial Services				
63	Audiovisual Maintenance				
71	Free Folder				
72	Sales Folders				
73	Books				
74	Archeological Publication				
75	Gen. Information Booklet				
76	Posters				
77	Special Publications				
	Other				
	Other				

DSC-HFC
Form 802

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

PACKAGE ESTIMATING DETAIL

REGION	PARK
NORTH ATLANTIC	SPRINGFIELD ARMORY NHS
PACKAGE NUMBER: 103 A	PACKAGE TITLE: REHAB HISTORIC STRUCTURES - PHASE III

(If more space is needed, use plain paper and attach)

ITEM	QUANTITY	COST
BUILDINGS & UTILITIES -- FY 1983		
1. Interior preservation, adaptive use, Bldg. #1	Lump Sum	$522,000
2. Conservation lab. - outfit lab.	" "	40,000
TOTAL PHASE III		562,000
Estimate is valid to October 1983.		
R. Borras, 10/9/79		

SUMMARY OF CONSTRUCTION ESTIMATES

CLASS OF ESTIMATE: A ☐ Working Drawings   B ☐ Preliminary Plans   C ☒ Similar Facilities

Proj Type		Totals from Above B & U	R & T
52	Museum Exhibits		XXXXX
55	Wayside Exhibits		XXXXX
62	Audio-Visual		XXXXX
89	Ruins Stabilization		XXXXX
91	Construction	$562,000	
92	Utility Contracts		XXXXX

ESTIMATES APPROVED (Signature)	(title)	(date)
Gerald D. Patten	Assistant Manager, TNE	10/24/79

POST PROFESSIONAL SERVICES ESTIMATES AND SCHEDULING ON BACK OF FORM

SCHEDULING OF DEVELOPMENT RELATED PROJECT TYPES FY 83

Est. 562,000

DEVELOPMENT RELATED PROJECT TYPES

	(Add on to line item)	C-3 YEARS	C-2 YEARS	C-1 YEAR	C: YEAR OF CONSTRUCTION	Ini
07	Construction Drawings B&U					
07	Construction Drawings R&T					
36	Historic Structures Const. Drawings			85,000		
43	Archeological Salvage B&U					
43	Archeological Salvage R&T					
51	Museum Exhibit Design					
55	Wayside Exhibit Design					
61	Audiovisual Design					
	(Advance Planning)					
05	Surveys					
06	Comprehensive Design (Prel. Design)					
14	Utility Negotiations					
15	Special Studies					
34	Historic Furnishings Report					
35	Historic Structures Report (HIST)					
35	Historic Structures Report (ARCHIT)		34,000			
42	Archeological Research					

DISTRIBUTION OF ESTIMATED FUNDING REQUIREMENTS BY YEARS

	ALL OTHER PROJECT TYPES	1st Year	2nd Year	3rd Year	4th Year	
01	New Area Study					
02	Existing Area Study					
03	Development Concept Plan					
04	Interpretive Prospectus					
15	Special Studies (Non-Develop. Related)					
16	E.I.S.					
17	Service-wide Projects					
18	Wilderness Studies					
31	Archeological Investigations					
32	Park History Study					
33	Special History Report					
53	Museum Exhibit Operations					
54	Curatorial Services					
63	Audiovisual Maintenance					
71	Free Folder					
72	Sales Folders					
73	Books					
74	Archeological Publication					
75	Gen. Information Booklet					
76	Posters					
77	Special Publications					
	Other					
	Other					

DSC-HFC
Form 802

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

PACKAGE ESTIMATING DETAIL

REGION	PARK
NORTH ATLANTIC	SPRINGFIELD ARMORY NHS
PACKAGE NUMBER: 103 A	PACKAGE TITLE: REHAB HISTORIC STRUCTURES -- PHASE IV

(If more space is needed, use plain paper and attach)

ITEM	QUANTITY	COST
BUILDINGS & UTILITIES - FISCAL YEAR 1984		
1. Gatehouse, exterior restoration	Lump Sum	$20,000
2. Iron fence	" "	174,000
PHASE IV SUBTOTAL		194,000
BUILDINGS & UTILITIES - FISCAL YEAR 1985		
1. Gatehouse interior restoration	" "	$32,000
PHASE IV SUBTOTAL		32,000
PHASE IV TOTAL		226,000
This estimate is valid to October of Fiscal Year indicated.		
R. Borras, 10/9/79		

SUMMARY OF CONSTRUCTION ESTIMATES

CLASS OF ESTIMATE: A ☐ Working Drawings B ☐ Preliminary Plans C ☒ Similar Facilities

Proj. Type		Totals from Above B & U	R & T
52	Museum Exhibits		XXXXX
55	Wayside Exhibits		XXXXX
62	Audio-Visual		XXXXX
89	Ruins Stabilization		XXXXX
91	Construction	$226,000	
92	Utility Contracts		XXXXX

ESTIMATES APPROVED (signature)	(title)	(date)
[signature]	Assistant Manager, TNE	10/24/79

POST PROFESSIONAL SERVICES ESTIMATES AND SCHEDULING ON BACK OF FORM

SCHEDULING OF DEVELOPMENT RELATED PROJECT TYPES

FY 85 Est. 32,000

FY 84 Est. 194,000

	DEVELOPMENT RELATED PROJECT TYPES (Add on to line item)	C-3 YEARS	C-2 YEARS	C-1 YEAR	C: YEAR OF CONSTRUCTION	Ini
07	Construction Drawings B&U					
07	Construction Drawings R&T					
36	Historic Structures Const. Drawings		30,000	5,000		
43	Archeological Salvage B&U					
43	Archeological Salvage R&T					
51	Museum Exhibit Design					
55	Wayside Exhibit Design					
61	Audiovisual Design					
	(Advance Planning)					
05	Surveys					
06	Comprehensive Design (Prel. Design)					
14	Utility Negotiations					
15	Special Studies					
34	Historic Furnishings Report					
35	Historic Structures Report (HIST)	12,000	2,000			
35	Historic Structures Report (ARCHIT)					
42	Archeological Research					

DISTRIBUTION OF ESTIMATED FUNDING REQUIREMENTS BY YEARS

	ALL OTHER PROJECT TYPES	1st Year	2nd Year	3rd Year	4th Year	
01	New Area Study					
02	Existing Area Study					
03	Development Concept Plan					
04	Interpretive Prospectus					
15	Special Studies (Non-Develop. Related)					
16	E.I.S.					
17	Service-wide Projects					
18	Wilderness Studies					
31	Archeological Investigations					
32	Park History Study					
33	Special History Report					
53	Museum Exhibit Operations					
54	Curatorial Services					
63	Audiovisual Maintenance					
71	Free Folder					
72	Sales Folders					
73	Books					
74	Archeological Publication					
75	Gen. Information Booklet					
76	Posters					
77	Special Publications					
	Other					
	Other					

Project Estimate Summary - June 17, 1982
Building 13, Main Arsenal - Interior Adaptive Use

Basement		$ 340,814
First Floor		516,212
Second Floor		1,102,298
Third Floor		96,968
Attic		6,200
	Total	$2,062,492
Elevator		99,200
	Total	$2,161,692
Fire Detection/Security		427,800
	Total	$2,589,492
Restore Finishes, Third Floor		175,398
	Total	$2,764.890
Partial Halon System		142,000
Fiscal Year 1984[1]	Total	$2,907,490
Fiscal Year 1985	Total	$3,256,389
Fiscal Year 1986	Total	$3,647,155

1. Use for comparison with Form 802 escalated totals.

Project Estimate - June 17, 1982
Building 13, Main Arsenal - Interior Adaptive Use

	FY 82	FY 84
<u>Basement</u>		
1. Dead storage: 1,000 sf @ 30.00	$30,000	$37,200
2. High security storage: 1,000 sf @ 35.00	35,000	43,400
3. Heavy storage: 2,000 sf @ 30.00	60,000	74,400
Floor sealer or paint Shelving Temperature and humidity control Lighting (?)		
4. Work shop: 2,500 sf @ 20.00	50,000	62,000
Floor sealer or paint Wiring <u>No</u> humidity control		
5. Staff offices: 620 sf @ 50.00	31,000	38,440
Carpet and wiring		
6. Other areas: 6,480 sf @ 5.00	33,000	40,920
Rewiring		
Total	$239,000	$296,360
15 percent contingency	36,000	44,454
Total	$275,000	$340,814

Project Estimate - June 17, 1982
Building 13, Main Arsenal - Interior Adaptive Use

		FY 82	FY 84
<u>First Floor</u>			
1. Restore finishes		$ 97,000	$120,280
a. Refinishing floor: 11,600 sf @ 3.00	- 35,000		
b. Ceiling: 11,600 sf @ 4.00 Sandblast Paint	- 47,000		
c. Walls: 7,200 sf @ 2.00 Paint Plaster repair (minor)	- 15,000		
2. Restroom: 400 sf @ 150.00		60,000	74,400
3. Museum office: 620 sf @ 50.00		31,000	38,400
4. Lighting: 11,600 sf @ 5.00		58,000	71,920
5. HV/AC: 11,600 sf @ 10.00		116,000	143,840
	Total	$362,000	$448,880
15 percent contingency		54,300	67,332
	Total	$416,300	$516,212

Project Estimate - June 17, 1982
Building 13, Main Arsenal - Interior Adpative Use

		FY 82	FY 84
Second Floor			
1.	Restore finishes (same as first floor)	$ 97,000	$120,280
2.	Restroom (staff): two unisex 200 sf @ 150.00	30,000	37,200
3.	Library: 2,000 sf @ 50.00	100,000	124,000
4.	Laboratory: 2,600 sf @ 100.00	260,000	322,400
	Does not include equipment		
5.	Darkroom: 300 sf @ 100.00	30,000	37,200
6.	Collection storage: 5,400 sf @ 35.00	189,000	234,360
7.	General space lighting: 2,400 sf @ 5.00	12,000	14,880
8.	General space HV/AC: 2,400 sf @ 10.00	24,000	29,760
9.	Administrative offices: 620 sf @ 50.00	31,000	38,440
	Total	$773,000	$958,520
15 percent contingency		116,000	143,778
	Total	$889,000	$1,102,298

Project Estimate - June 17, 1982
Building 13, Main Arsenal - Interior Adaptive Use

		FY 82	FY 84
Third Floor			
1. Lighting (rewire): 13,600 sf @ 5.00		$ 68,000	$ 84,320
	Total	$ 68,000	$ 84,320
15 percent contingency		10,200	12,648
	Total	$ 78,200	$ 96,968
NIC			
Restore finishes 13,600 sf @ 9.00	Total	$123,000	$152,520
15 percent contingency		18,450	22,878
	Total	$141,450	$175,398
Attic			
1. Lighting (rewiring)		$ 5,000	$ 6,200

Project Estimate - June 17, 1982
Building 13, Main Arsenal - Interior Adaptive Use

		FY 82	FY 84
Systems - Independent			
1. Elevator: 4 stops @ 20,000		$ 80,000	$ 99,200
2. Fire detection/security: 69,000 sf @ 5.00		345,000	427,800
Partial Halon:			
Drop ceiling - 5,000 sf @ $4.00 - 20,000		20,000	24,800
Halon - 40,000 cf @ $2.99 cf - 80;000		80,000	99,200
	Total	$100,000	$124,000
15 percent contingency		15,000	18,600
	Total	$115,000	$142,600

PARK: SPRINGFIELD ARMORY NHS 1930
REGION: NORTH ATLANTIC REGION

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT NUMBER: NC28 COMBINED FORMULATION/EXECUTION COMPREHENSIVE PACKAGE LISTING 03/17/84

PKG DEVELOPED AREA / PACKAGE TITLE / PROJ REMARKS	FY	STATE CONG / PT-UNI	PWE	**PRIORITY*** WASO	REGION	RESP OFF	E S T	FY1983	FY1984	FY1985	FY1986	FY1987	FY1988	FUTURE
101		MA	02											
GMP/CCP														
100	83	03-401	399		2.5	DSTNE	L	1						
PACKAGE 101 TOTAL								1						
103 PARK GENERAL		MA	02											
REHAB STRUCTURES														
	78LH36-401		402	134.0	.0	DSTNE	L							
	79LH91-401		404		14.0	DSTNE	L	1027						
FIELD TRIP TAKEN - 51 61 INVOLVEMENT	82	06-403	400	134.0	11.0	HF	E	23						
$55,000 FROM 37-1930-090ADDED 6-82.	82L127-021		403		.0	DSTNE	E	2						
PLUS $10700PL/IP WR 83-3	82	35-303	399	134.0	11.0	DSTNE	E	37						
ADDED 2-83.	83LI27-030		403		.0	DSTNE	E	5						
	84	06-404	402	134.0	11.0	DSTNE	E							
ARMORY CONST DRAWINGS	84	36-501	402	134.0	11.0	DSTNE	E							
	84	42-302	402	134.0	11.0	DSTNE	E							
	84	51-401	402	134.0	11.0	HF	E							
SPECIAL HISTORY STUDY	86	15-401	402	134.0	11.0		F				73			
	86	36-307	402	134.0	11.0	DSNED	F				115			
	86	61-401	402	134.0	11.0	HF	F				23			
	87	52-401	404	134.0	11.0	HF	F					1170		
	87	55-402	404	134.0	11.0	HF	F					38		
	87	64-401	404	134.0	11.0	HF	F					113		
	87LH91-404		404	134.0	11.0	DSNED	*F					1486		
DESIGN UNDERWAY	87LH91-405		404	134.0	11.0	DSNED	F					763		
	88	91-406	404	134.0	11.0	DSNED	F						1136	
	89	36-402	402	134.0	11.0	DSNED	F							508
PACKAGE 103 TOTAL 6,652								1094	335		211	3570	1136	508
106 PARK GENERAL		MA	02											
RESTORE HIST GRNDS/ARSENAL & COMMANDANT'S HOUSE														
	85	35-302	399	319.0	28.0	DSNED	F			10				
	86	06-402	399	319.0	28.0	DSNED	*F				10			
	86	15-501	399	319.0	28.0	DSNED	F				1			
	86	43-402	402	319.0	28.0	NA	F				34			
	87	07-402	402	319.0	28.0	DSNED	*F					26		
	87	36-420	402	319.0	28.0	DSNED	F					1		
GROUNDS/BLDG 1-13	87	36-421	402	319.0	28.0	DSNED	F					60		
	87	42-401	399	319.0	28.0	DSNED	F					1		

*** PKG 106 CONTINUED *** SPRINGFIELD ARMORY NHS

APPENDIX J

CONSTRUCTION CONTRACTS COMPLETED

CONSTRUCTION CONTRACTS COMPLETED

During the preparation of this revised historic structure report several construction contracts were issued in order to perform preservation maintenance work, to resolve health, safety, and security problems, and to respond to requests from Springfield Technical Community College for the park to get off existing steam and electrical central systems run by the college. A listing of contracts issued and a summary of the work are presented. Greater detail on each contract can be obtained in the contract completion reports, as-built drawings, and contract files.

1. Preservation/Restoration, Buildings 1 and 13; Package 103, CX-1600-9-9010; Drawing 458/25,000, Start: October 4, 1979, Completion: January 23, 1981 Contract amount $695,566.

The basic contract goal was to repair the structures exterior envelope in order to assure a weather-tight enclosure. The work involved repair and replacement of roofs; repair of window assemblies; repair and replacement of snow rail assemblies; and repointing of masonry. During the course of the work, repair and replacement of the Arsenal tower roof framing, repair of Arsenal roof trusses, and repair and replacement of Commanding Officer's House porch framing was required.

2. New Heating System, Buildings 1 and 13; Package 103, CX-1600-1-9005, Drawing 458/41,001, Start: July 30, 1981, Completion: December 21, 1981, Contract amount $115,734.

The basic contract goal was to allow the park to become independent of the STCC central steam system. The work involved the installation of new steam boilers in Buildings 1 and 13, which would supply steam for heating. Modular boilers were used to allow the systems to respond to varying loads and conserve energy. Completion of the work was dependent upon the gas service contract.

3. Gas Facilities and Service, Package 103, CX-1600-1-9902, Start: October 1981, Completion: November 30, 1981, Contract amount $30,000.

This contract provided underground gas service from State Street to Buildings 1 and 13. The gas line crosses STCC/Commonwealth of Massachusetts property.

4. New Electrical Service, Package 103, CX-1600-2-9001, Drawing 458/41,002, Start: June 7, 1982, Completion: January 1983 (estimate), Contract amount $25,113 (estimate).

The contract goal was to transfer the park from the unreliable, antiquated, STCC central system to a new system with contemporary voltages. The work involved underground primary and secondary cables to Buildings 1 and 13, primary switches, transformer, and interior distribution panels.

6. Interior Restoration - Building 13, Package 103, CX-1600-2-9004, Drawing 458/25,001A, Start: September 20, 1982, Completion: January 1983 (estimate), Contract amount $136,025 (estimate).

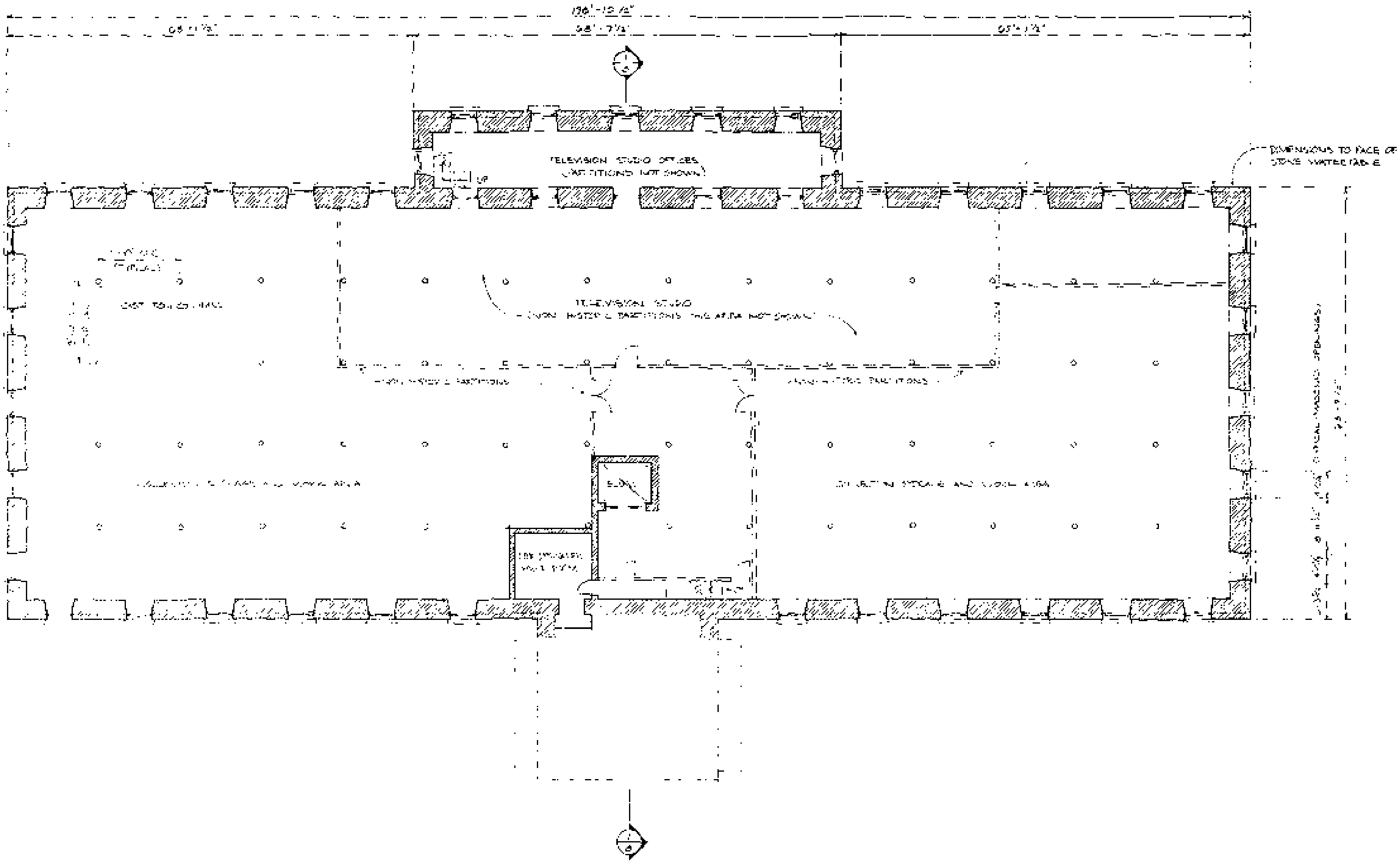
The contract goal was to improve emergency egress from Building 13, to increase building security, and to improve thermal performance of the windows. The work included modifying historic windows for emergency exit, adding exits in the basement, and installing interior thermal/security windows.

5. Purchase Order: Western Massachusetts Electric Company (WMECO), Package 103, Purchase order amount $2,584.91, issued by park.

This purchase order purchased the work required from WMECO to install the new electrical service. This purchase order was coordinated with the work under contract CX-1600-2-9001, New Electrical Service.

6. Preservation Maintenance - Building 10, Construction amount: $18,000 Start: July 1982, Completion: October 1982, work performed by regional staff.

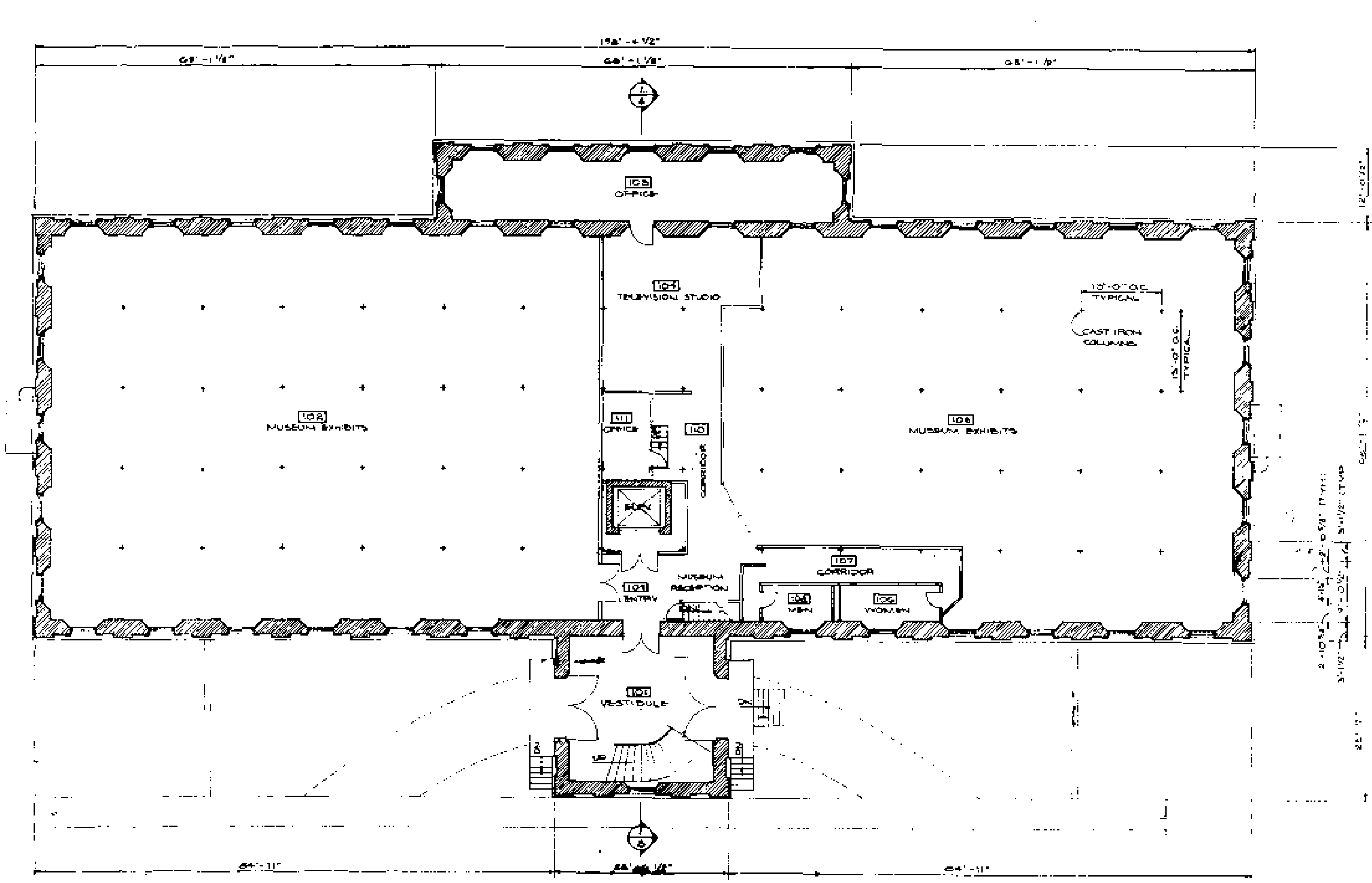
The project goal was to repair and preserve the side porch of Building 10. The work involved repair and replacement of porch framing, flooring, and ceiling.



BASEMENT PLAN
SCALE: 1/8" = 1'-0"
0 5 10 15 20 25 30 FEET
0 1 2 3 4 5 10 METERS

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N. H. S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWING

PREPARED R.L. CARPER	DRAWING NO.	
DESIGNED R.L. CARPER		
DRAWN R.L.G.	PKG. NO. 102	SHEET 1
CHECKED JULY 1978 DATE		OF 11



1/2 FIRST FLOOR PLAN

SCALE 1/8" = 1'-0"

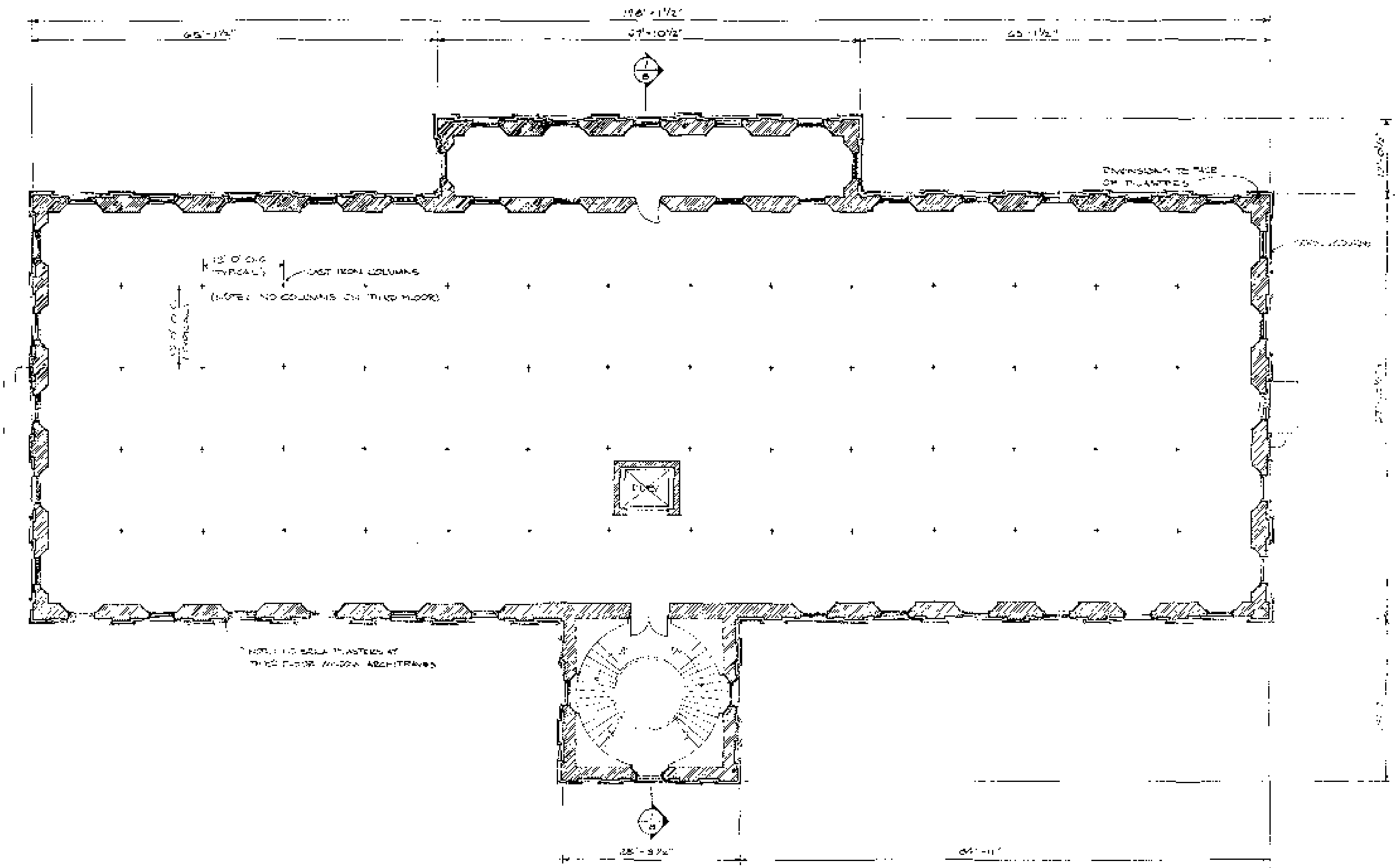
0 5 10 15 20 25 30 FEET

0 1 2 3 4 5 10 METERS

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N.H.S.

HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS

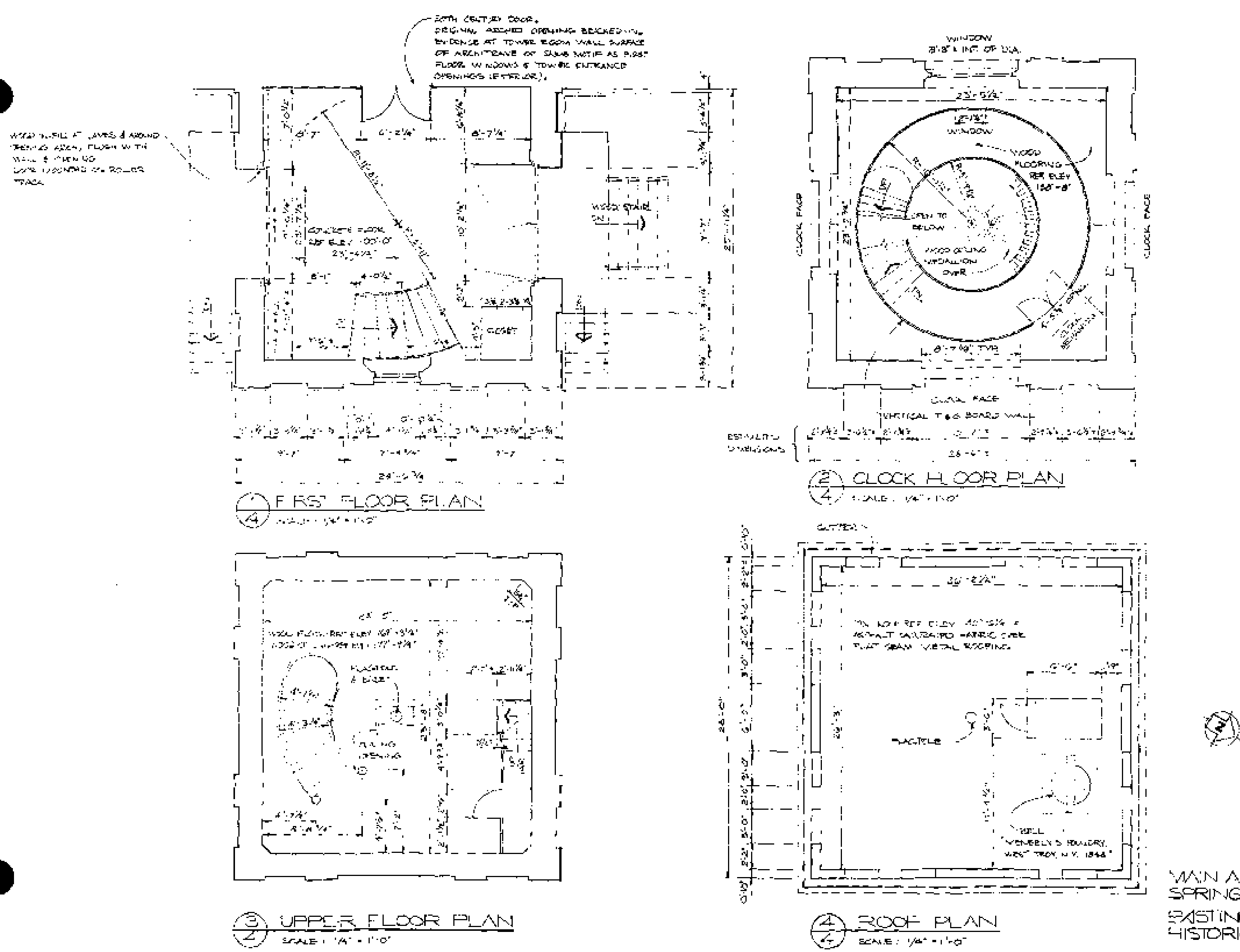
PREPARED R.L. CARPER DESIGNED	DRAWING NO. 425 25001
R.L. CARPER DRAWN	FILE NO. 102
E.L.C. CHECKED	SHEET 2
JULY 1979 DATE	OF 13



1/3 SECOND FLOOR PLAN
(THIRD FLOOR SIMILAR)
SCALE: 1/8" = 1'-0"
0 5 10 15 20 25 30 FEET
0 5 10 METERS

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT–
EXISTING CONDITIONS DRAWING

PREPARED	DRAWING NO.
R. L. CARPER	455
DESIGNED	80001
R. L. CARPER	PKG NO. 102
DRAWN	SHEET
R. L. C.	3
CHECKED	OF 11
JULY 1993	
DATE	



NOTES:

FIRST FLOOR
STAIR DATA
CLEAR WIDTH AT BASE: 5'-7" ±
RAIL HEIGHT AT TREAD NOSING: 2'-5"
" " AT RISER: 2'-10"
TREAD AT RAIL: 10 3/4" TO 11 1/4"
" AT WALL: 17 1/4" TO 17 1/4"
RISERS, TYPICAL: 7 3/4"
FIRST RISER: 4 5/8"
TREAD NOSING THICKNESS, TYPICAL: 1 1/4"
EXTERIOR STAIRS AT LOADING DOCK (CONCRETE EXCEPT AS INDICATED):
TREADS: 10" TO 11"
RISERS: 7" ± EXCEPT TOP RISER 5"
WALLS: PLASTERED, PAINTED
CLOSET DOOR: INOPERABLE
STAIR RAIL: VERTICAL T & G BOARDING

SECOND, THIRD & ATTIC FLOOR LEVELS (PLANS NOT SHOWN)
LANDING FLOORS: WOOD
SPIRAL STAIR WITHIN CIRCULAR WALL
WALLS: PLASTERED, PAINTED
STAIR DATA AT ATTIC LEVEL:
CLEAR WIDTH: 5'-11"
TREAD AT RAIL: 9 1/2"
TREAD AT WALL: 3 1/4"
RISERS: 7 3/4"
UNDERSIDE OF STAIR: PLASTERED, PAINTED

CLOCK FLOOR
INTERIOR FACE OF EXTERIOR WALLS: PLASTERED
CEILING OUTSIDE STAIRWAY ENCLOSURE: PLASTERED, INSIDE STAIRWAY ENCLOSURE: WOOD

UPPER FLOOR
WALLS: PLASTERED
STAIR NEWELS: WOOD, OCTAGONAL
STAIR RAIL: VERTICAL T & G BOARDING & SHAPED WOOD RAIL (TYP)
CEILING: 3/4" WOOD T & G

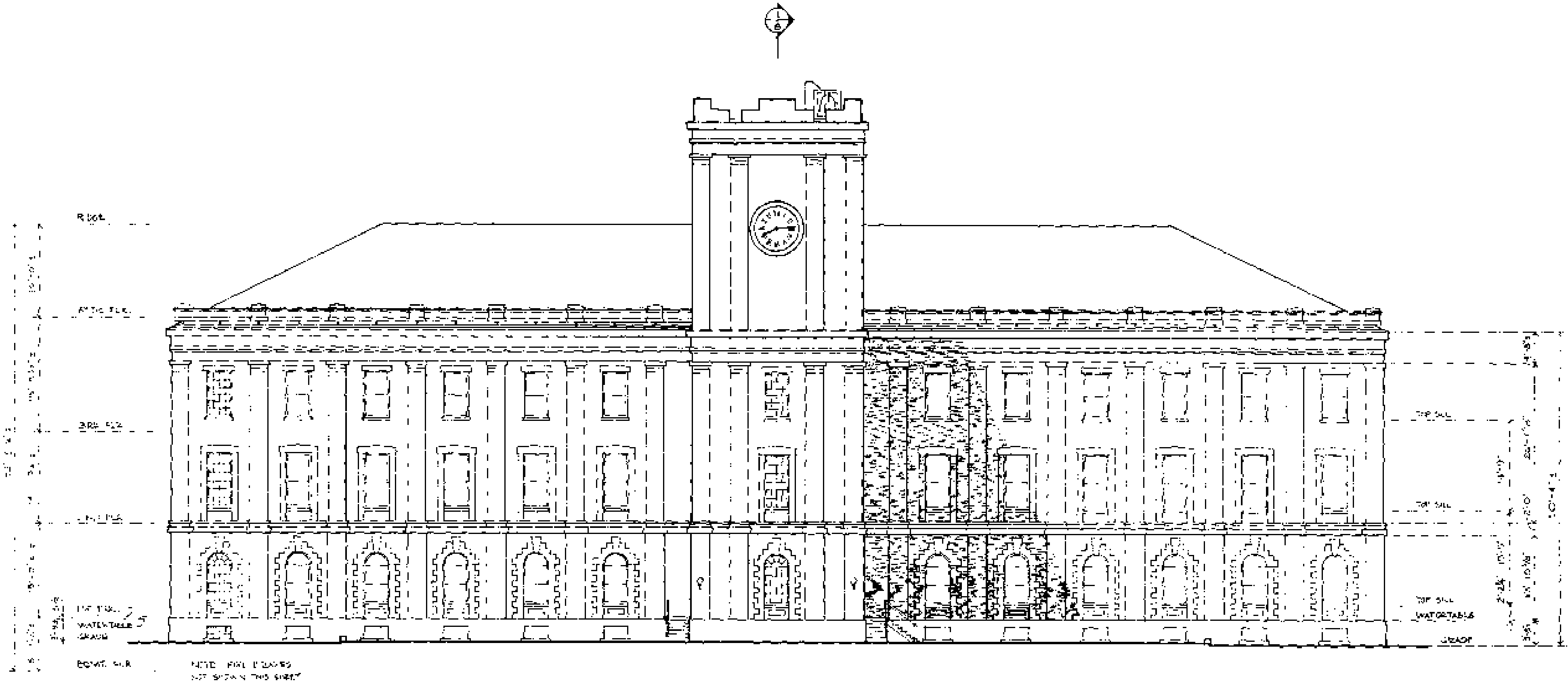
TOWER FLOOR PLANS

0 1 2 3 4 5 10 15 FEET

0 1 2 3 4 5 METERS

MAIN ARSENAL BLDG 13
SPRINGFIELD ARMORY
EXISTING CONDITIONS
HISTORIC STRUCTR RPT

PREPARED CARTER	DRAWING NO. 456	
DESIGNED CARTER	28001	
DRAWN E.L.C.	PKG NO 102	SHEET 4
CHECKED JULY 1978 DATE		OF 11



1/5 NORTHEAST (FRONT) ELEVATION

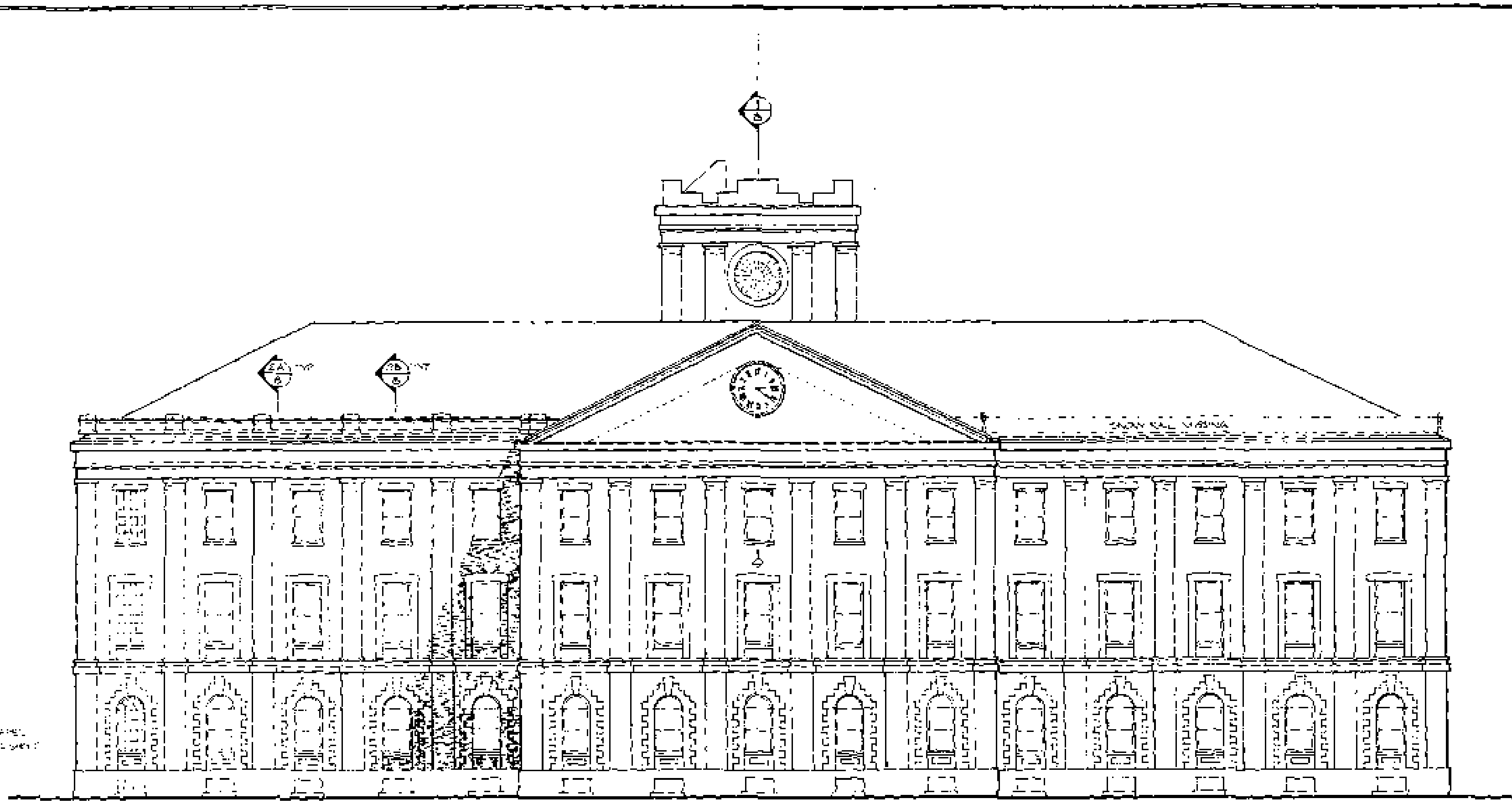
SCALE: 1/8" = 1'-0"

0 5 10 20 30 40 50 FEET

0 5 10 15 METERS

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWING

PREPARED	DRAWING NO.
R.L. CARPER DESIGNED	458 / 28001
E. CARPER DRAWN	PKG. NO. 102 / SHEET 5
E.J.C. CHECKED	
JULY 1976 DATE	OF 11



1/6 SOUTHWEST ELEVATION

SCALE: 1/8" = 1'-0"

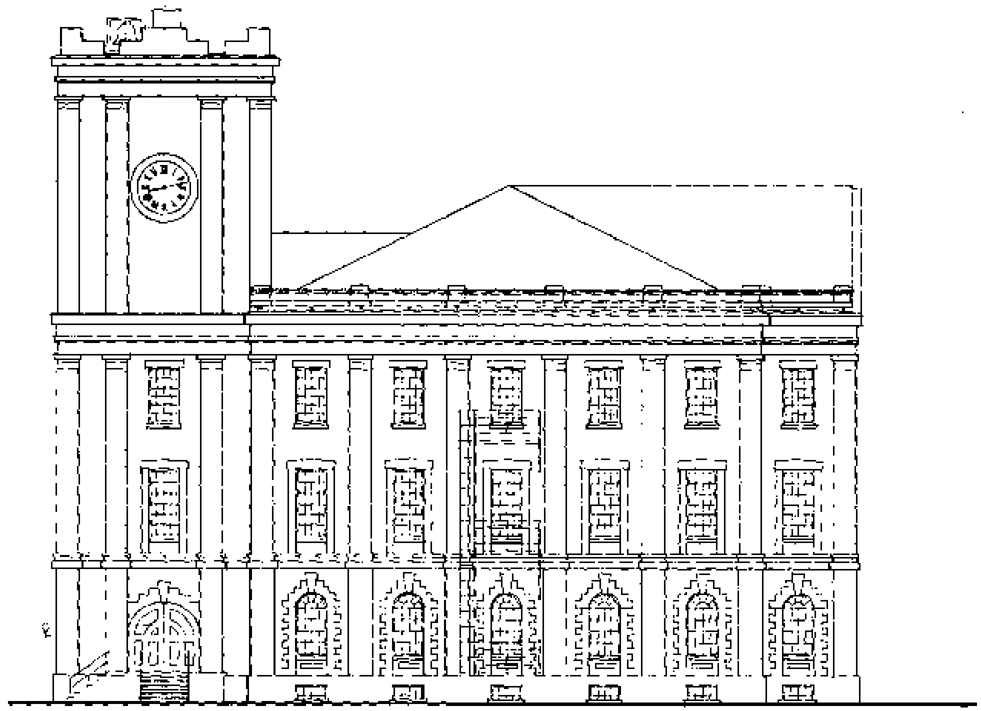
0 5 10 20 30 40 50 FEET

0 5 10 15 METERS

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N. H. S.

HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWING

PREPARED R.L. CARPER	DRAWING NO. 455 25001
DESIGNED R.L. CARPER	SHEET 6 OF 11
DRAWN R.L.C.	
CHECKED JULY 1978 DATE	



NORTHWEST ELEVATION

SCALE : 1/8" = 1'-0"

0 5 10 20 30 40 50 FEET

0 5 10 15 METERS

NOTE : SOUTHEAST ELEVATION SIMILAR

ON MICROFILM

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N. H. S.

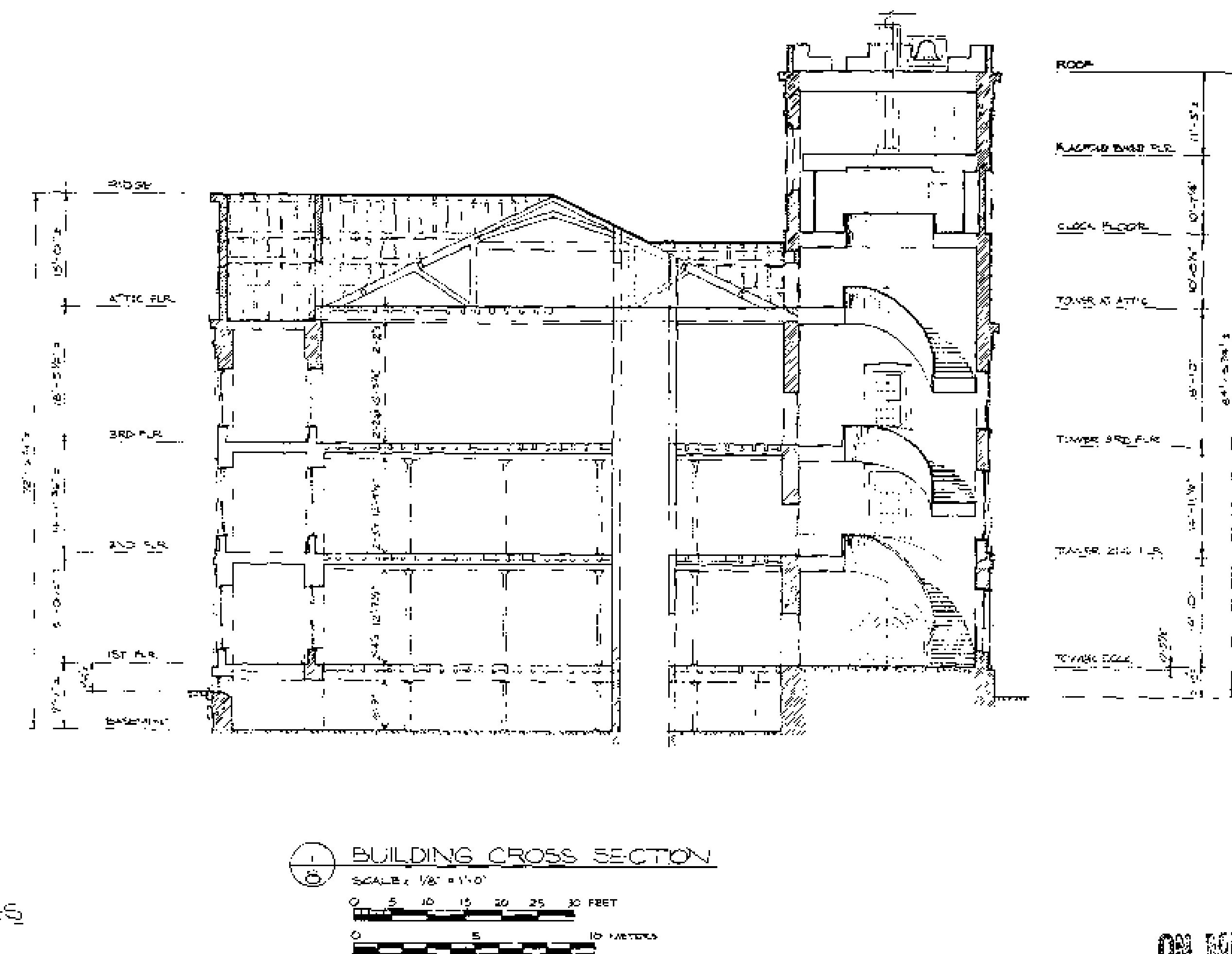
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWING

PREPARED	DRAWING NO.
R.L. CARPER, DESIGNED	458 / 28001
R.L. CARPER, DRAWN	PKG. NO. 102
R.L.C., CHECKED	SHEET 7
JULY 1978, DATE	OF 11

2A/8 WALL   22/8 WINDOWS

2/8 TYPICAL EXTERIOR WALL PROFILES

SCALE: 1/2" = 1'-0"



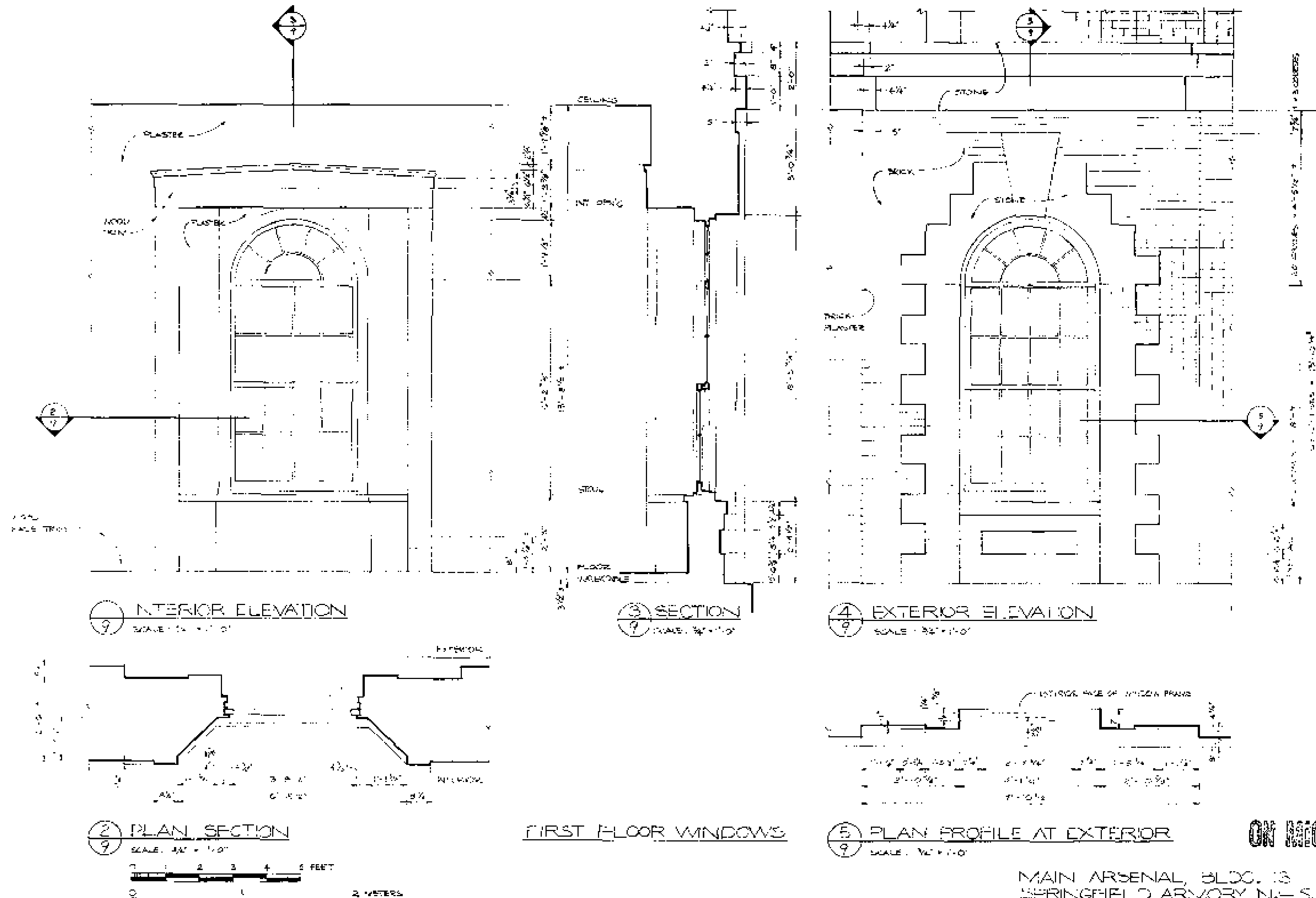
1/8 BUILDING CROSS SECTION

SCALE: 1/8" = 1'-0"

ON MICROFILM

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N. H. S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWING

PREPARED	DRAWING NO.
R.L. CARPER	458
DESIGNED	A8001
R.L. CARPER	SHEET
DRAWN	8
R.L.C.	
CHECKED	
JULY 1978	OF 11
DATE	

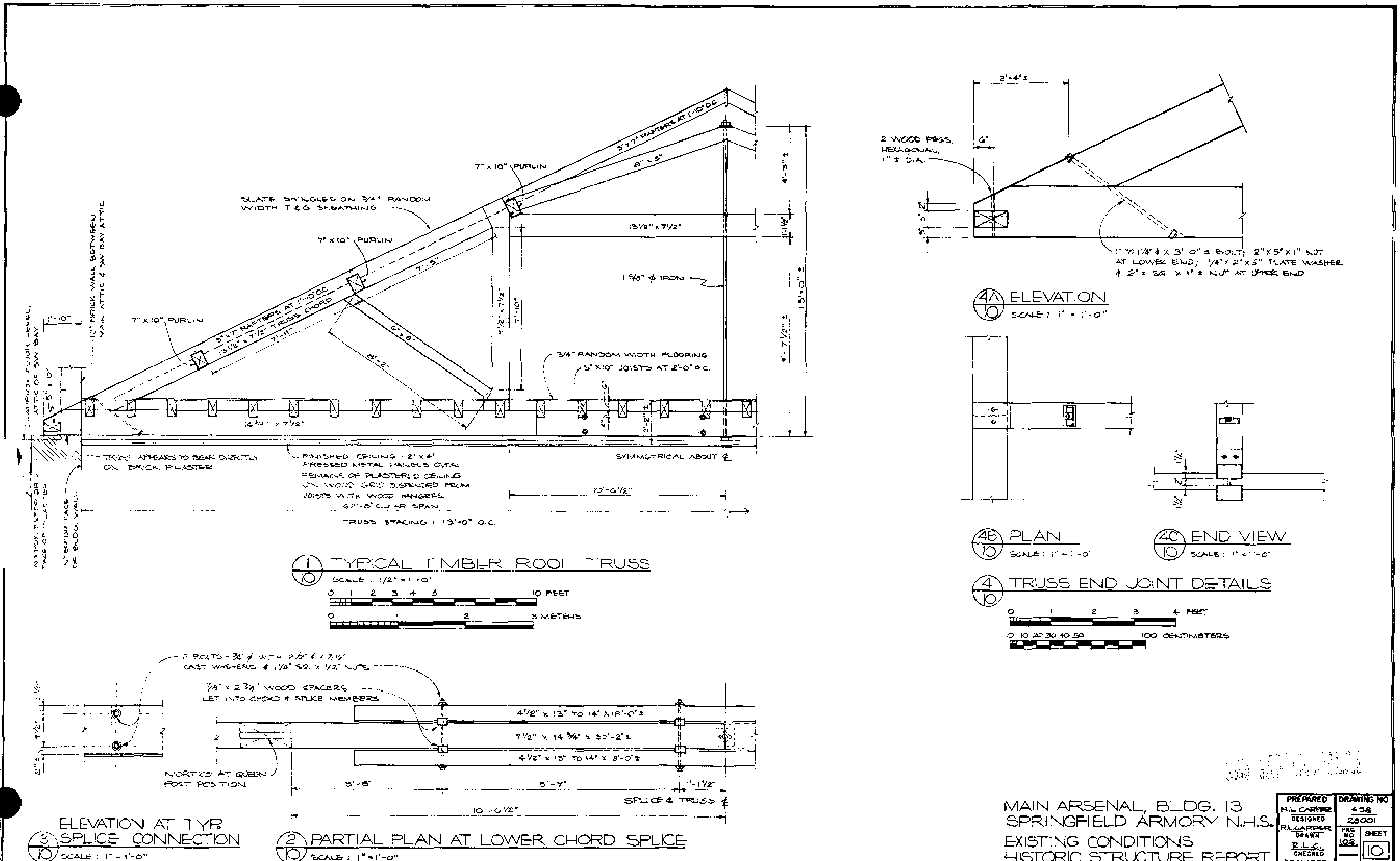


ON MICROFILM

MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N.H.S.

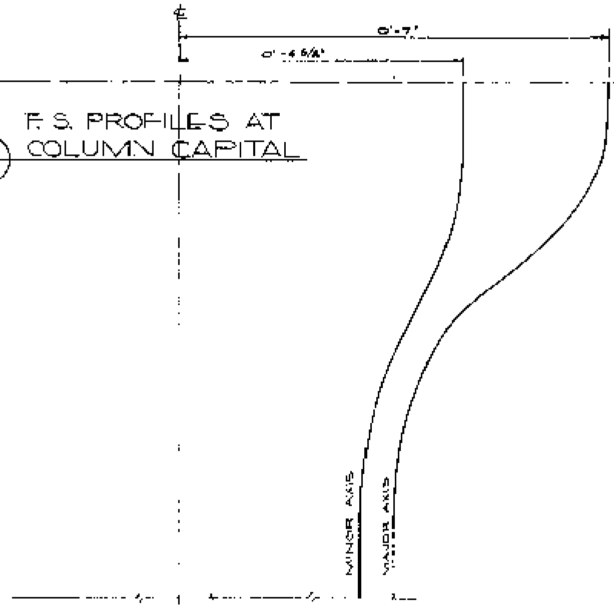
EXISTING CONDITIONS
HISTORIC STRUTURE REPORT

PREPARED CARPER	DRAWING NO. 455 28001
DESIGNED CARPER	PKG. NO. 102
DRAWN	SHEET 9
CHECKED	OF 11
DATE	

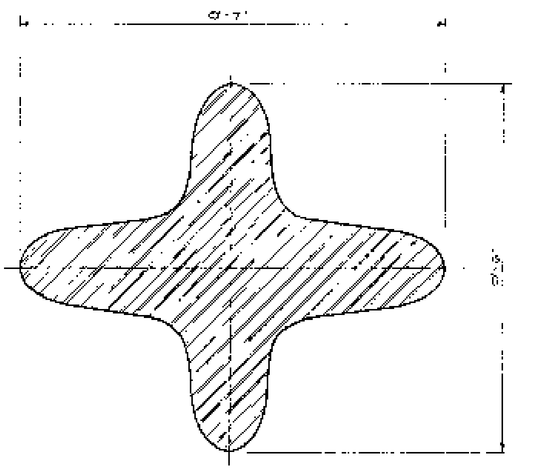


MAIN ARSENAL, BLDG. 13
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO
N.L. CARTER / DESIGNED	458 / 25001
R.L. CARPER / DRAWN	PKG NO 102 / SHEET 10
R.L.C. / CHECKED	
JULY 1978 / DATE	OF 11

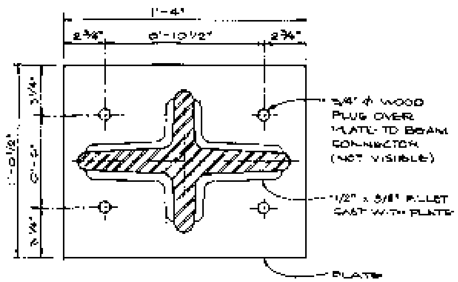


5/11 F. S. PROFILES AT COLUMN CAPITAL

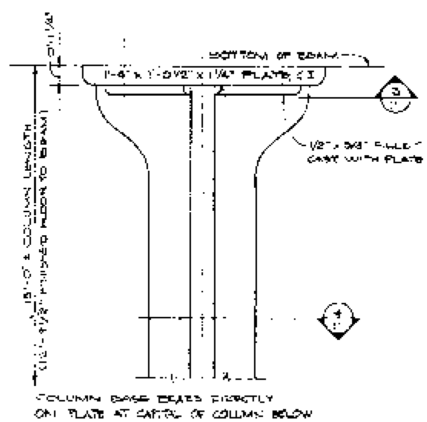


4/11 F. S. PLAN SECTION OF COLUMN

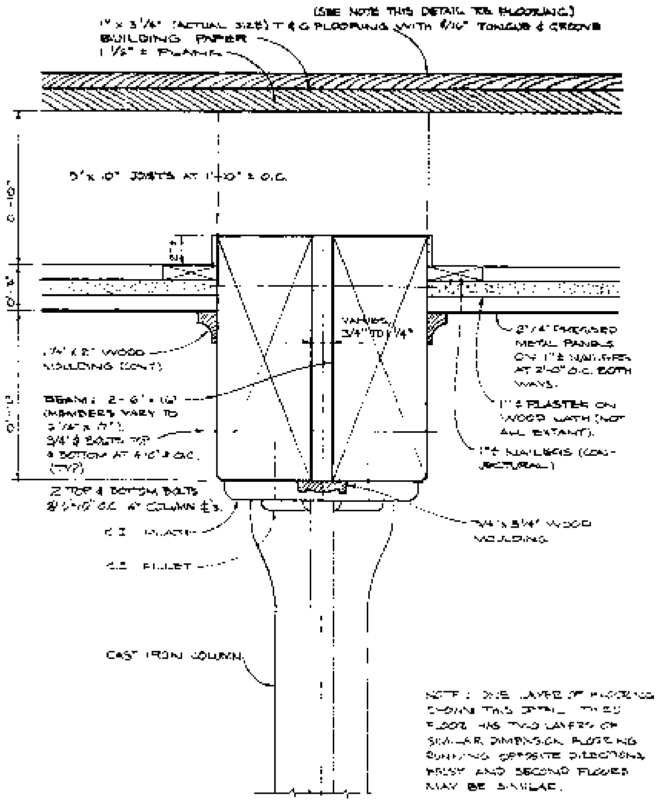
0 1 2 3 4 5 6 INCHES
0 1 2 3 4 5 10 15 CENTIMETERS



3/11 SECTION
SCALE : 3" = 1'-0"



2/11 DETAIL AT COLUMN CAPITAL
SCALE : 3" = 1'-0"



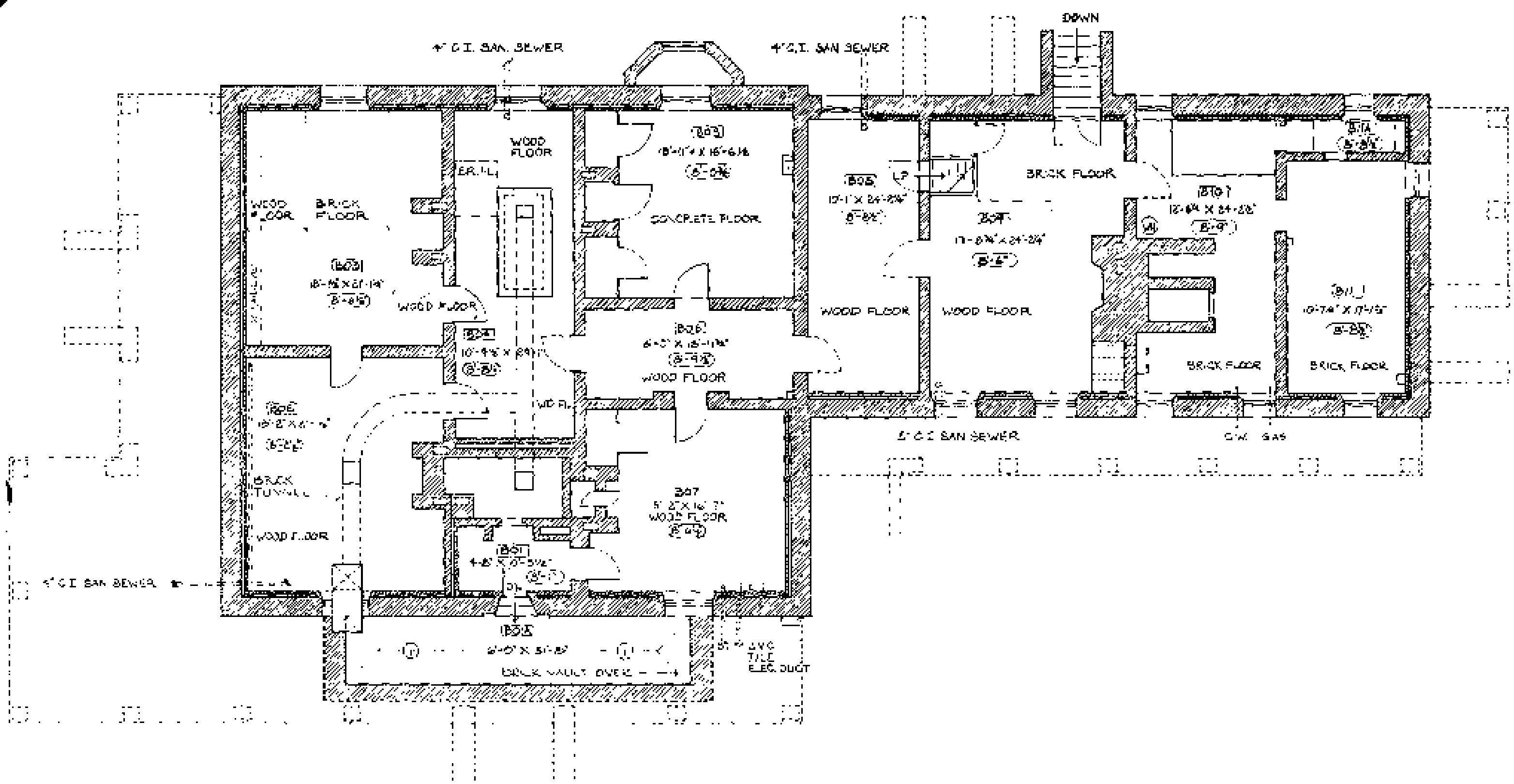
1/1 SECTION - FLOOR FRAMING
SCALE : 3" = 1'-0"

0 1 2 3 4 5 6 9 12 15 18 INCHES
0 10 20 30 40 50 CENTIMETERS

MAIN ARSENAL - BLDG. 13
SPRINGFIELD ARMORY N. H. S.

HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS

PREPARED	DRAWING NO.
R. L. CARPER / DESIGNED	458 / 28001
R. L. CARPER / DRAWN	PKG NO. 109 / SHEET 11
R. L. C. / CHECKED	
JULY 1978 / DATE	OF 11



LEGEND

B01	ROOM NUMBERS
(8'-8")	FLOOR TO CEILING DIMENSION
	BRICK
	STONE
C.I.	CAST IRON
V.C.	VITRIFIED CLAY
WD	WOOD
FLR.	FLOOR
BR.	BRICK
W.H.	WATER HEATER
ST	STEAM
CW	COLD WATER

BASEMENT PLAN

SCALE: 3/16" = 1'-0"

0 5 10 15 20 FEET

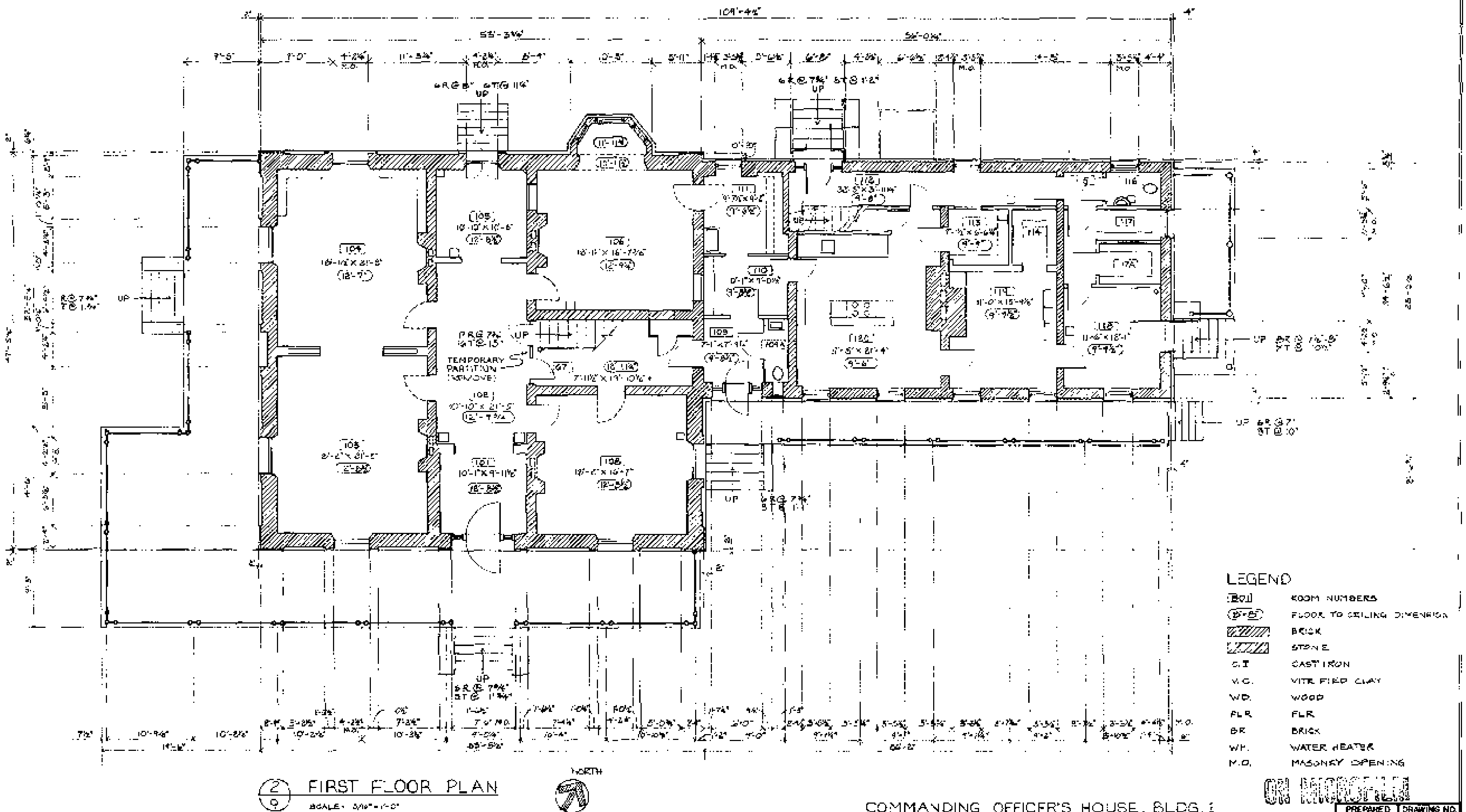
0 1 2 3 4 5 METERS

NORTH

ON MICROFILM

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

PREPARED	DRAWING NO.
R. CARPER DESIGNED	438 / 28072
P. DESAUTELS DRAWN	SHEET 1
R.L. CARPER CHECKED	
JULY 1976 DATE	OF 9



2/9 FIRST FLOOR PLAN

SCALE: 3/16" = 1'-0"

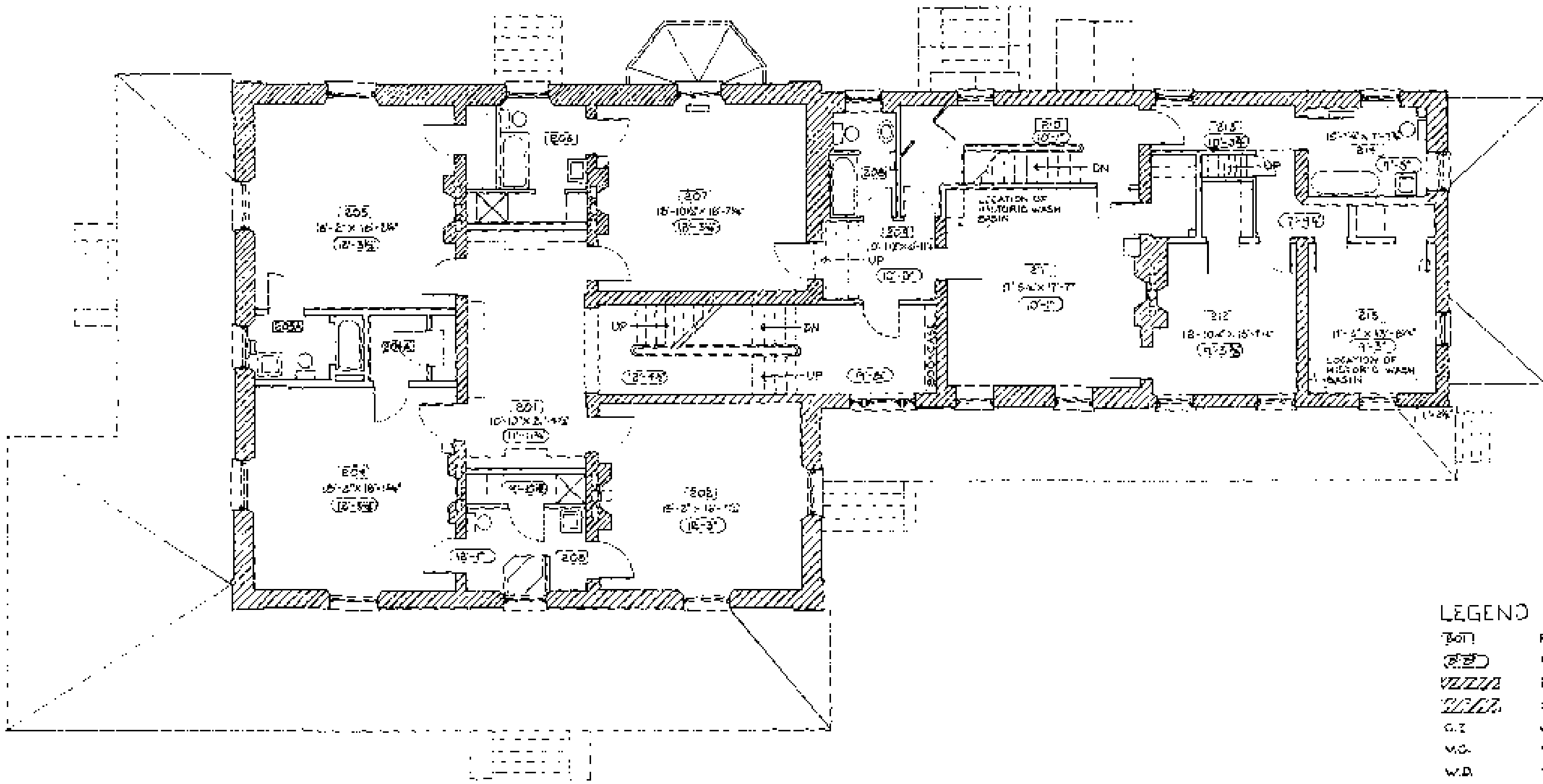
0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

ON MICROFILM

PREPARED	DRAWING NO.
R.L. CARPER	458 / 28002
DESIGNED	
P. DESSAUER	SHEET 2 OF 7
DRAWN	
R.L. CARPER	
CHECKED	
JULY 1978	
DATE	



3/9 SECOND FLOOR PLAN

SCALE: 3/16" = 1'-0"

0 5 10 15 20 FEET

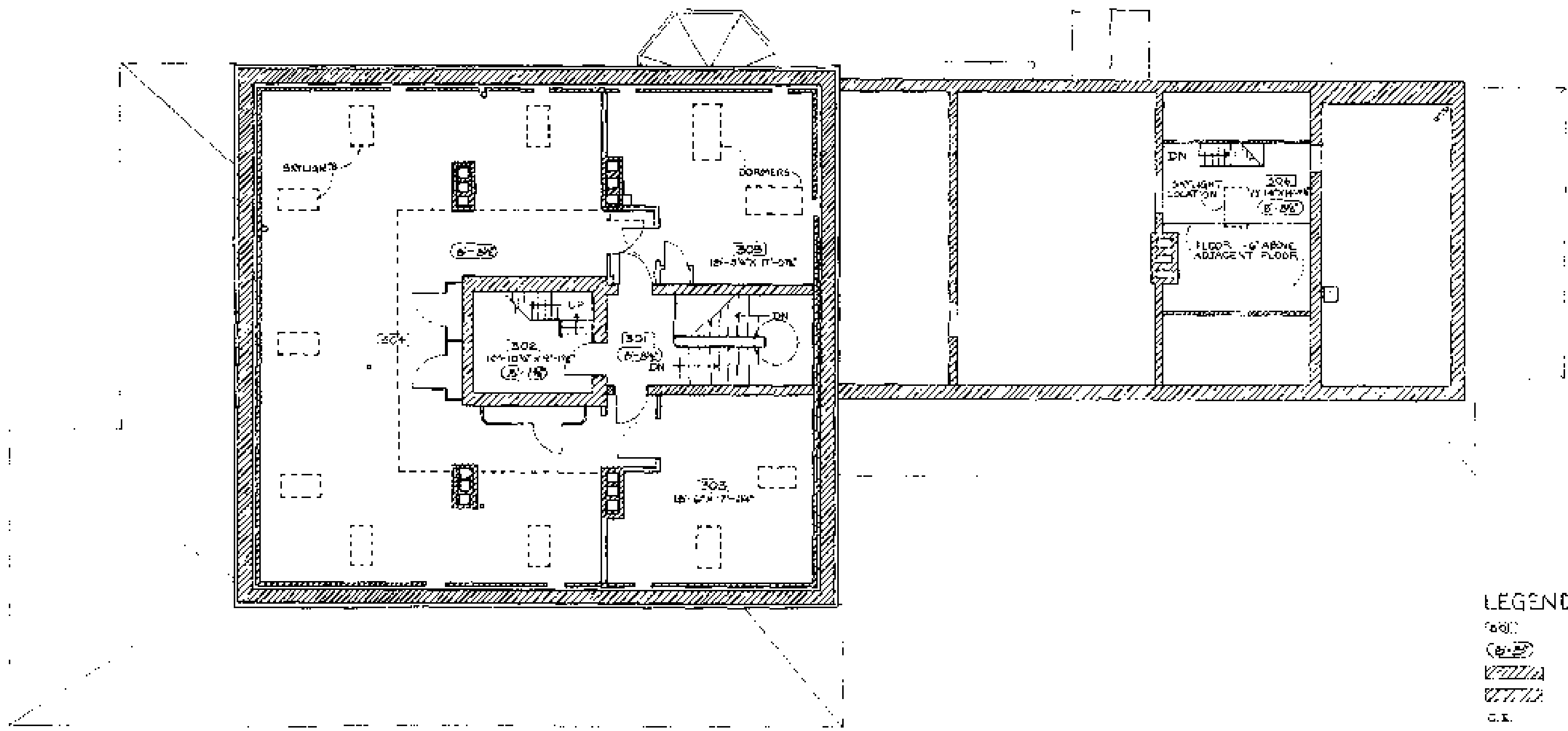
0 1 2 3 4 5 METERS

LEGEND

201	ROOM NUMBERS
	FLOOR-CEILING DIMENSION
	BRICK
	STONE
C.I.	CAST IRON
V.C.	VITRIFIED CLAY
W.D.	WOOD
FLR.	FLOOR
BR.	BRICK
W.H.	WATER HEATER
M.O.	MASONRY OPENING

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWING
AND PROPOSED PRESERVATION TREATMENT

PREPARED: R.L. CARPER	DRAWING NO. 458 / 28002
DESIGNED: B. BRUMMAN	PCTP PKG 103
DRAWN: R.L. CARPER	SHEET 3
CHECKED	OF 9
DATE: JULY 1978	



LEGEND

301	ROOM NUMBERS
(8'-8")	FLOOR TO CEILING DIMENSION
	BRICK
	STONE
C.I.	CAST IRON
V.C.	VITRIFIED CLAY
W.D.	WOOD
FLR	FLOOR
BR	BRICK
WH	WATER HEATER
M.O.	MASONRY OPENING

ON MICROFILM

4/9 ATTIC PLAN

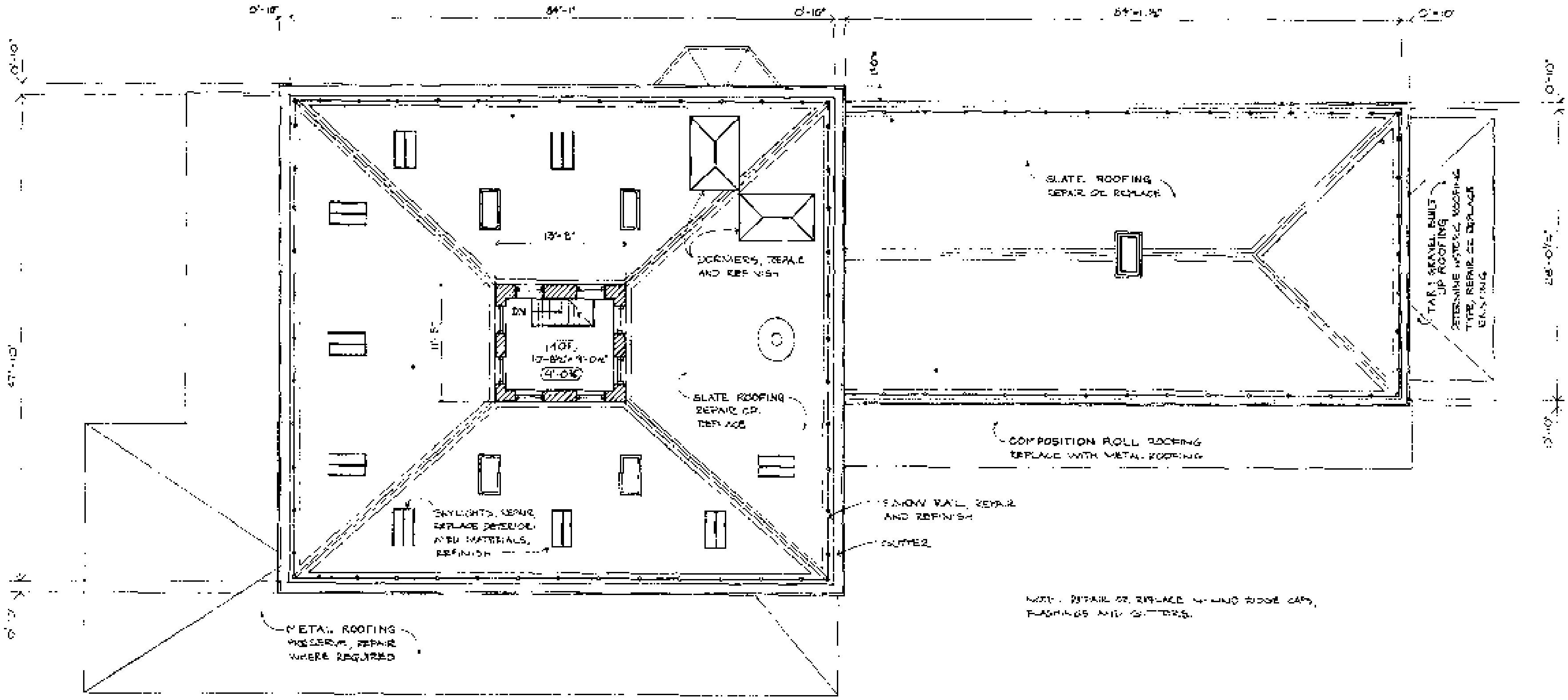
SCALE: 3/16" = 1'-0"

0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

PREPARED	DRAWING NO.
R.L. CARPER DESIGNED	458 28002
DRAWN	SHEET 4
R.L. CARPER CHECKED	
JULY 1978 DATE	OF 9



5/9 CUPOLA FLOOR PLAN AND ROOF PLAN

SCALE: 3/16" = 1'-0"

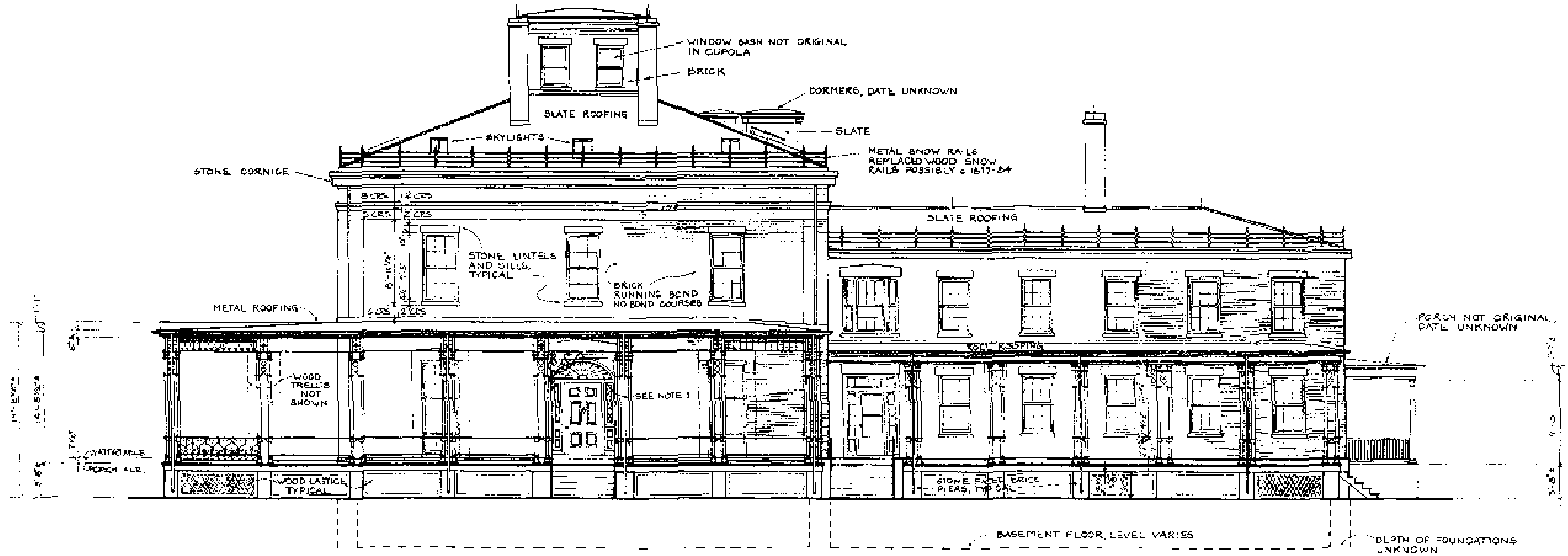
0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

ON MICROFILM

PREPARED	DRAWING NO.
R.L. CARPER DESIGNED	458 / 25002
R. DESSAUER DRAWN	SHEET 5
R.L. CARPER CHECKED	
JULY 1978 DATE	



NOTES:
1. ENTRY FANLIGHT AND SIDELIGHTS LEADED GLASS, POSSIBLY c. 1900. ORIGINAL TRANSOM WAS RECTANGULAR
2. EXISTING PORCHES DATE FROM c. 1877-84, EXCEPT AS NOTED.
3. REMOVE ALL EXISTING ALUMINUM STORM SASH AND DOORS. INSTALL WOOD FRAME SCREENS, DOORS, STORM SASH OR DOORS OF PERIOD DESIGN.
4. REPAIR OR REPLACE EXTERIOR HARDWARE.
5. REPAIR OR REPLACE RIDGE CAPS, FLASHINGS, GUTTERS AND DOWNSPOUTS
6. REPAIR SNOW RAIL AND REFINISH
7. REPAIR AND REFINISH DOORS AND WINDOWS.
8. REFINISH PORCH IRONWORK. (NOTE: HALF OF SCROLLWORK AT MAIN ENTRY SHOWN).
* REPOINT BRICK AND STONE WORK

K. SEE REPORT TEXT FOR TREATMENT DETAILS.

6/9 FRONT (SOUTHEAST) ELEVATION

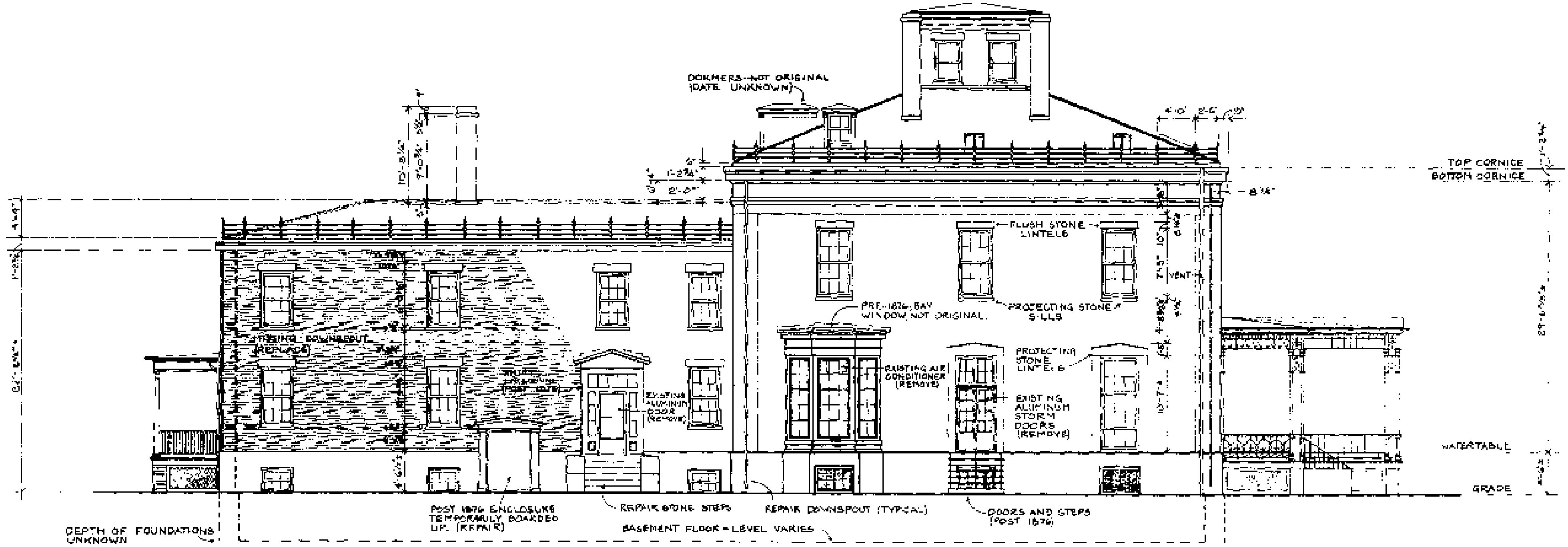
SCALE: 3/16" = 1'-0"

0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

PREPARED R. L. CARPER	DRAWING NO. 458 28002
DESIGNED R. GESHAUER	
DRAWN R. L. CARPER	SHEET 6
CHECKED	
JULY 1976 DATE	



REAR (NORTHWEST) ELEVATION

SCALE: 3/16" = 1'-0"

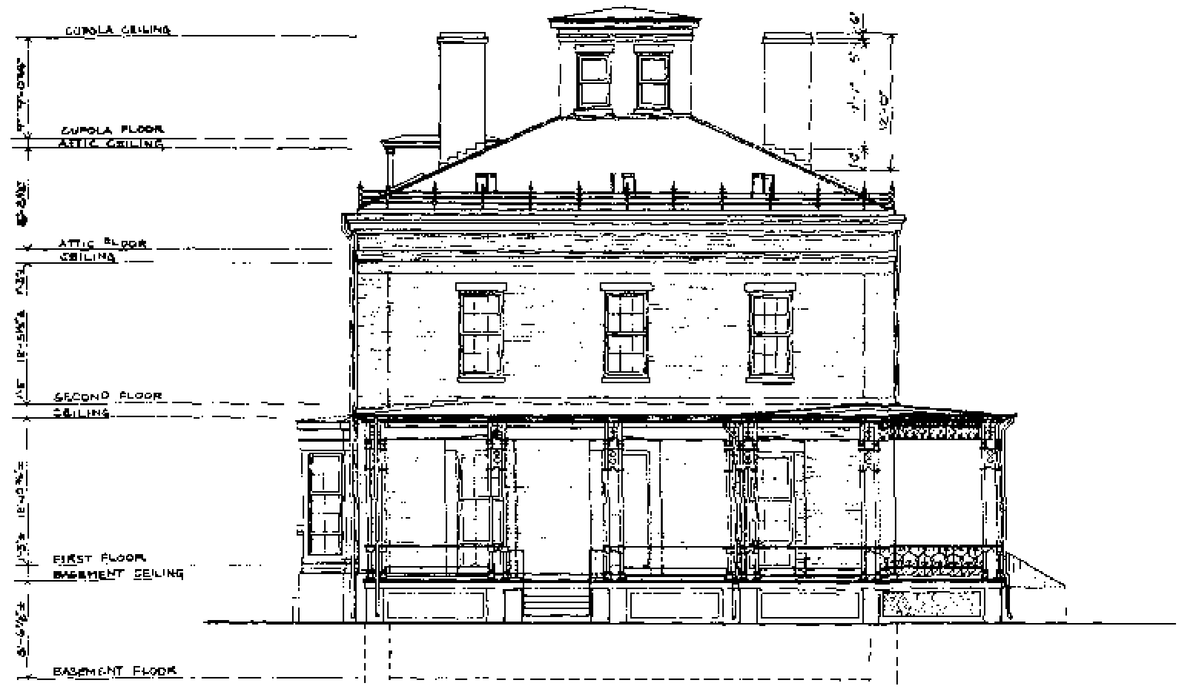
0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

ON MICROFILM

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

PREPARED	DRAWING NO.
R.L. CARPER DESIGNED	456 / 28,002
P. DESSAUER DRAWN	SHEET 7
R.L. CARPER CHECKED	
JULY 1978 DATE	OF 9



SOUTHWEST ELEVATION

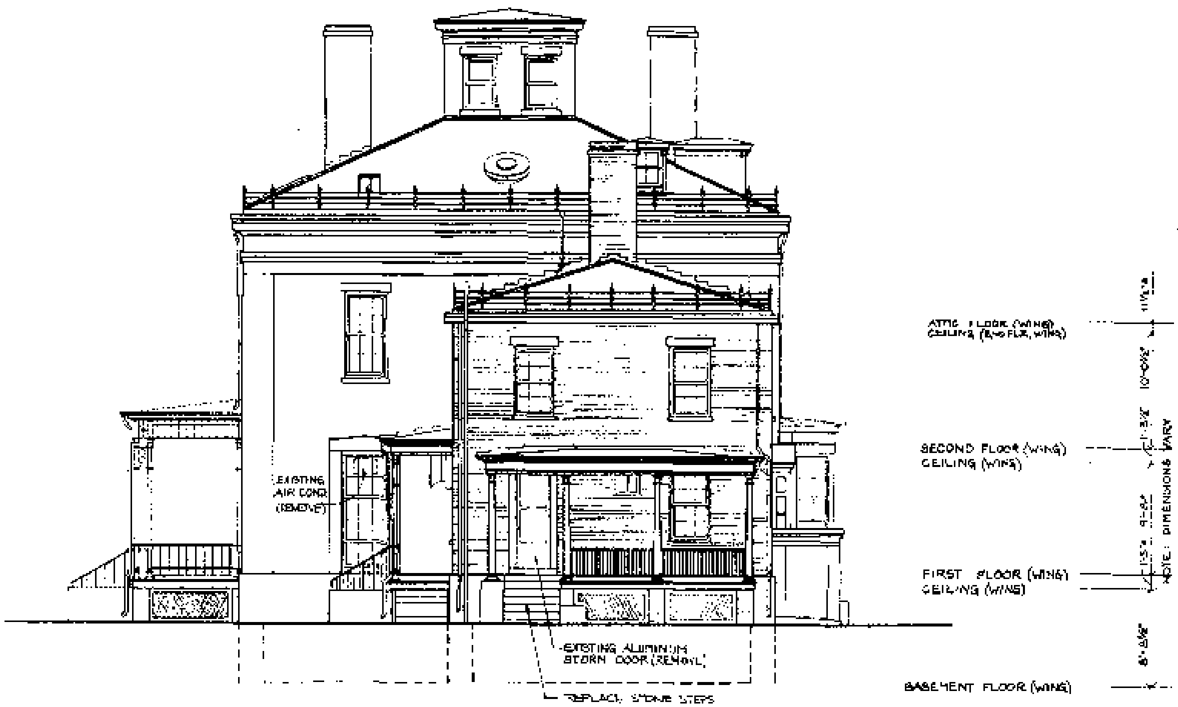
SCALE: 3/16" = 1'-0"

0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

PREPARED	DRAWING NO.
R. L. CARPER DESIGNED	458 28002
P. DEBBAUER DRAWN	PKG SHEET
R. L. CARPER CHECKED	8
JULY 1978 DATE	OF 9



NORTHEAST ELEVATION

SCALE: 3/16" = 1'-0"

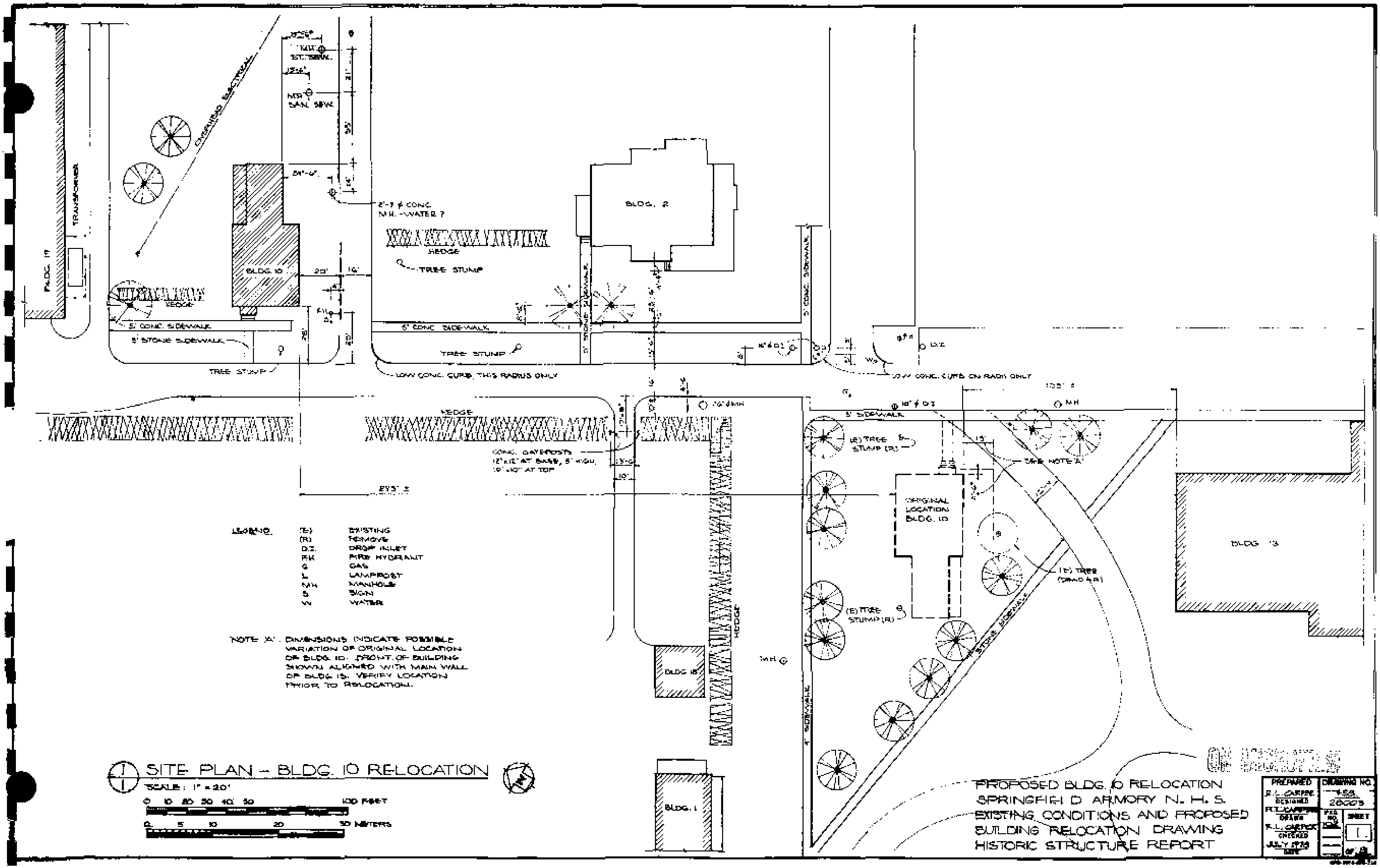
0 5 10 15 20 FEET

0 1 2 3 4 5 METERS

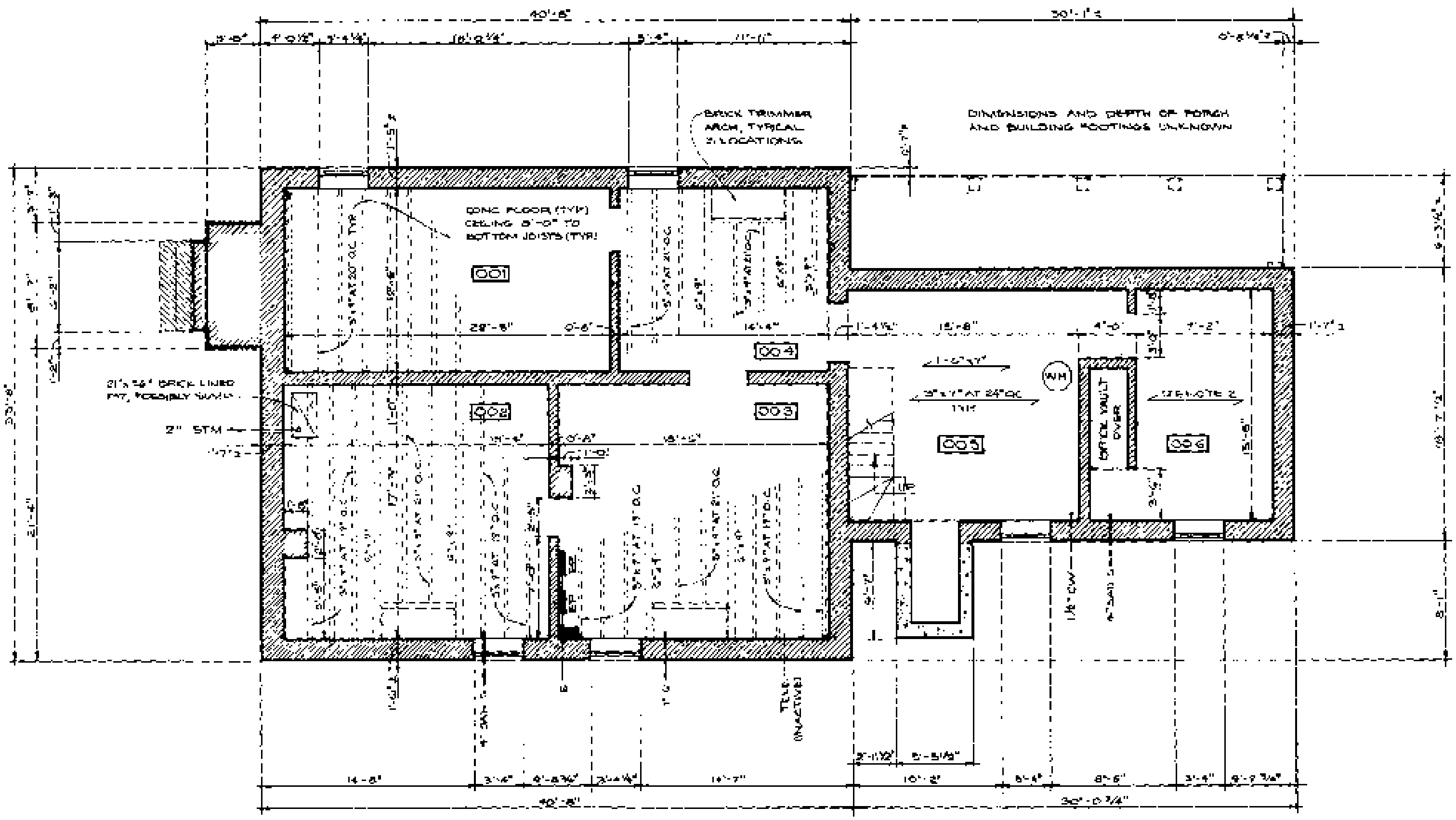
COMMANDING OFFICER'S HOUSE, BLDG. 1
SPRINGFIELD ARMORY N.H.S.
HISTORIC STRUCTURE REPORT
EXISTING CONDITIONS DRAWINGS
AND PROPOSED PRESERVATION TREATMENT

ON MICROFILM

PREPARED	DRAWING NO.
R. L. CARPER DESIGNED	436 / 28002
R. [illegible] DRAWN	SHEET 9
R. L. CARPER CHECKED	
JULY 1996 DATE	



SITE PLAN - BLDG. 10 RELOCATION
SCALE: 1" = 20'
0 10 20 30 40 50 100 FEET
0 5 10 20 30 METERS
PROPOSED BLDG. 10 RELOCATION
SPRINGFIELD ARMORY N. H. S.
EXISTING CONDITIONS AND PROPOSED
BUILDING RELOCATION DRAWING
HISTORIC STRUCTURE REPORT
PREPARED
DESIGNED
DRAWN
CHECKED
DRAWING NO.
SHEET
LEGEND
(E) EXISTING
(R) REMOVE
D.I. DROP INLET
F.H. FIRE HYDRANT
G GAS
L LAMPPOST
MH MANHOLE
S SIGN
W WATER
NOTE 'A': DIMENSIONS INDICATE POSSIBLE VARIATION OF ORIGINAL LOCATION OF BLDG. 10. FRONT OF BUILDING SHOWN ALIGNED WITH MAIN WALL OF BLDG 13. VERIFY LOCATION PRIOR TO RELOCATION.
BLDG. 2
BLDG. 10
BLDG. 13
BLDG. 15
BLDG. 1
BLDG. 19
TRANSFORMER
OVERHEAD ELECTRICAL
HEDGE
TREE STUMP
5' CONC. SIDEWALK
5' STONE SIDEWALK
LOW CONC. CURB, THIS RADIUS ONLY
LOW CONC. CURB ON RADII ONLY
CONC. GATEPOSTS 12"x12" AT BASE, 5' HIGH, 10"x10" AT TOP
ORIGINAL LOCATION BLDG. 10
(E) TREE STUMP (R)
(E) TREE
SEE NOTE 'A'
5' SIDEWALK
4' SIDEWALK
STONE SIDEWALK
2'-3" ⌀ CONC. M.H. - WATER ?
MH ST. SEW.
MH SAN. SEW.
D.I.
MH



NOTES: (1) DIMENSIONS AT EXTERIOR OF FOUNDATION WALLS TAKEN BETWEEN GRADE AND [illegible] WATERTABLE. EXTERIOR FOUNDATION [illegible] ABOVE FLOOR, BRICK [illegible] INTERIOR WALLS ARE BRICK.
(2) FIRST FLOOR JOISTS OVER ROOM 006 ARE 3" X 8" AT 24" ± O.C. WITH CONTINUOUS [illegible] X 3" ADDED AT BOTTOM.

1/2 BASEMENT PLAN, BLDG 10

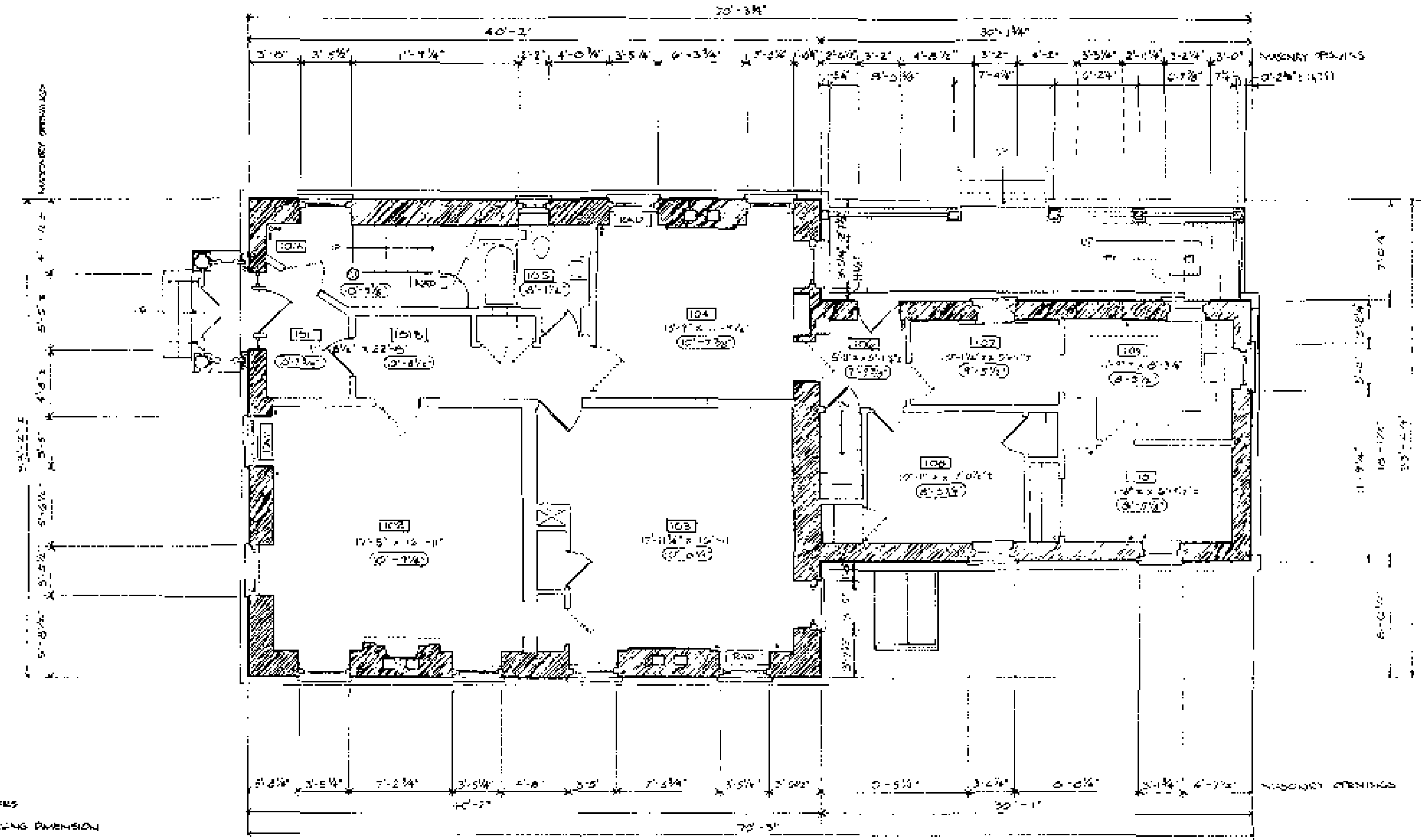
SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET

0 1 2 3 4 5 METERS

MASTER ARMORER'S QUARTERS
SPRINGFIELD ARMORY N. H. S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

SHEET 2



LEGEND:

101	ROOM NUMBERS
(8'-8")	FLOOR TO CEILING DIMENSION
(hatched)	BRICK
RAD	RADIATOR

3/9 FIRST FLOOR PLAN

SCALE: 1/4" = 1'-0"

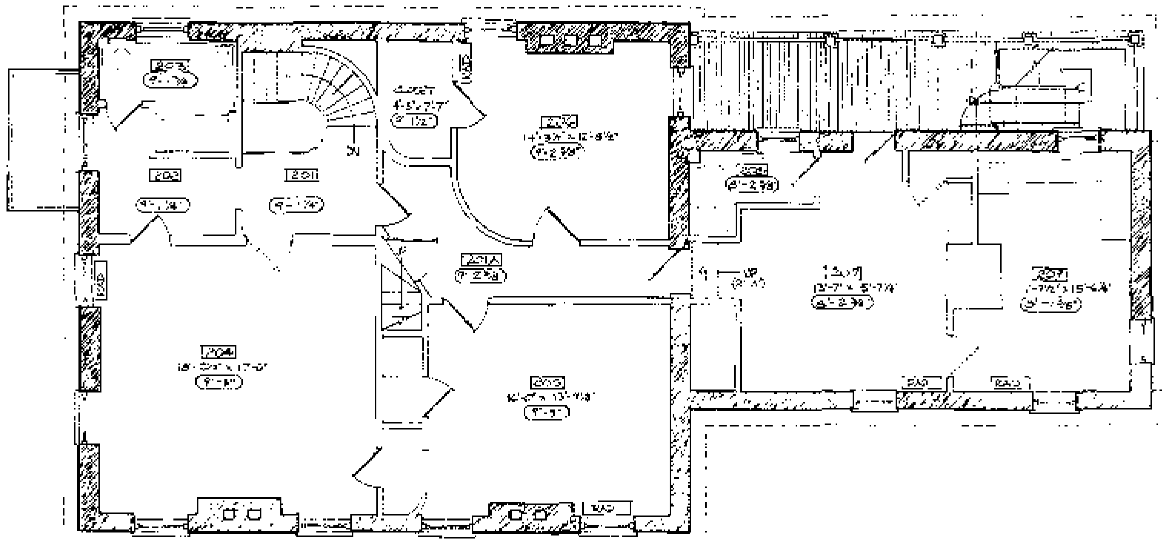
0 1 2 3 4 5 10 15 FEET

0 1 2 3 4 5 METERS

ON MICROFILM

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
R.L. CASPERZ	456
DESIGNED	28003
M.V.W.N.	
DRAWN	PKG. NO. 102
R.L.C.	SHEET 3
CHECKED	
AUG. 1978	OF 15
DATE	



LEGEND:

- 205 ROOM NUMBER
- (8'-8") FLOOR TO CEILING DIMENSION
- BRICK
- RAD RADIATOR

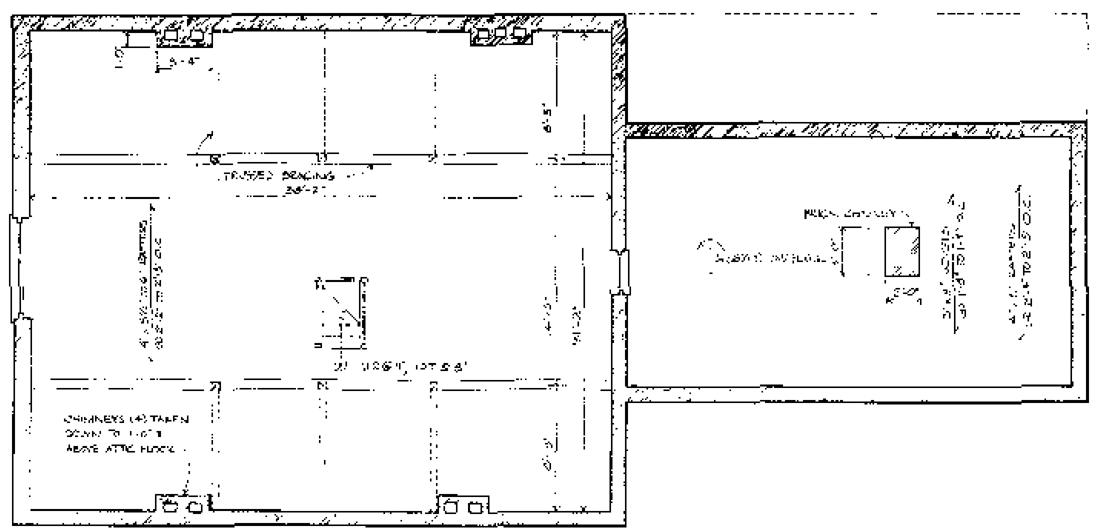
1/4 SECOND FLOOR PLAN

SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 FEET

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
R.L. CARPER	456 / 28003
DESIGNED W.M.A.	
DRAWN R.L.C.	SHEET 4
CHECKED	
JULY 1979 DATE	OF 15



(1/5) ATTIC PLAN

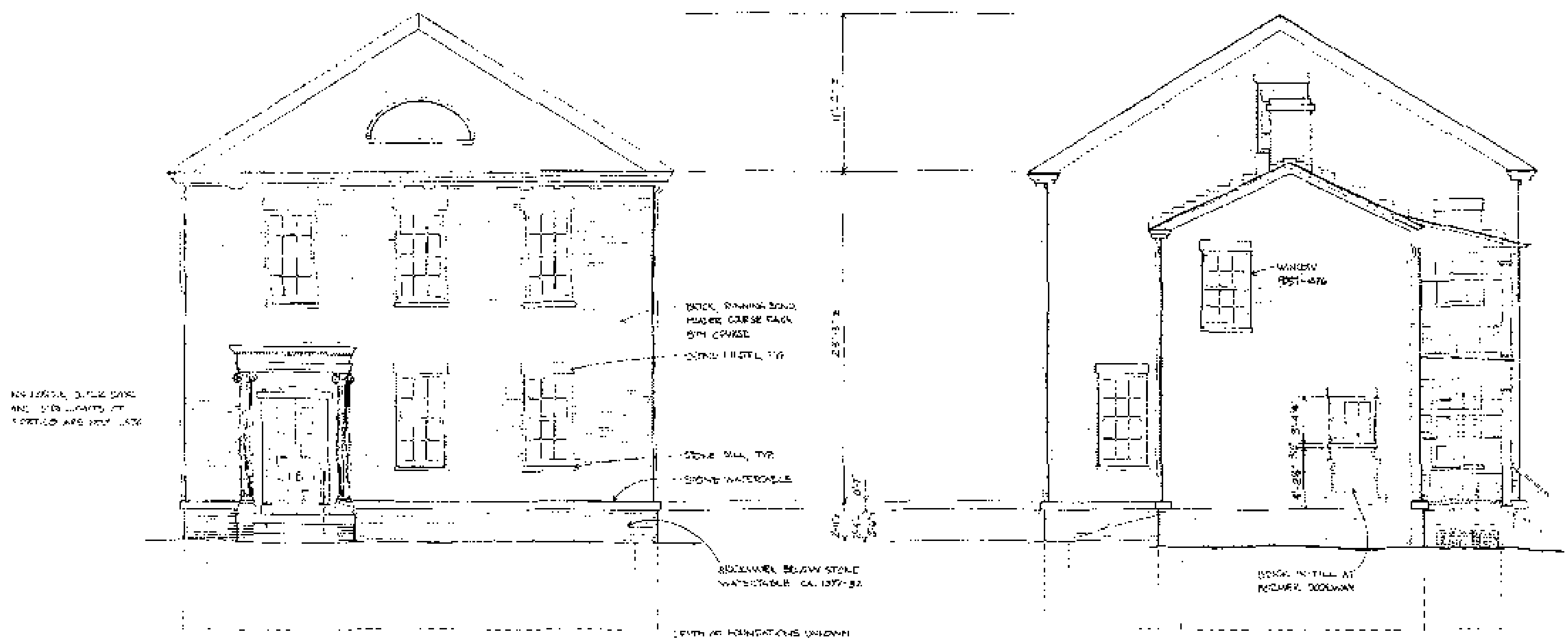
SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET

0 1 2 3 4 5 METERS

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
R.L. CARPER DESIGNED	455 / 25003
WYMA DRAWN	PCIP PKG.
R.L.C. CHECKED	SHEET 5
JULY 1976 DATE	OF 15



1/6 FRONT ELEVATION (S.W.)
SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET

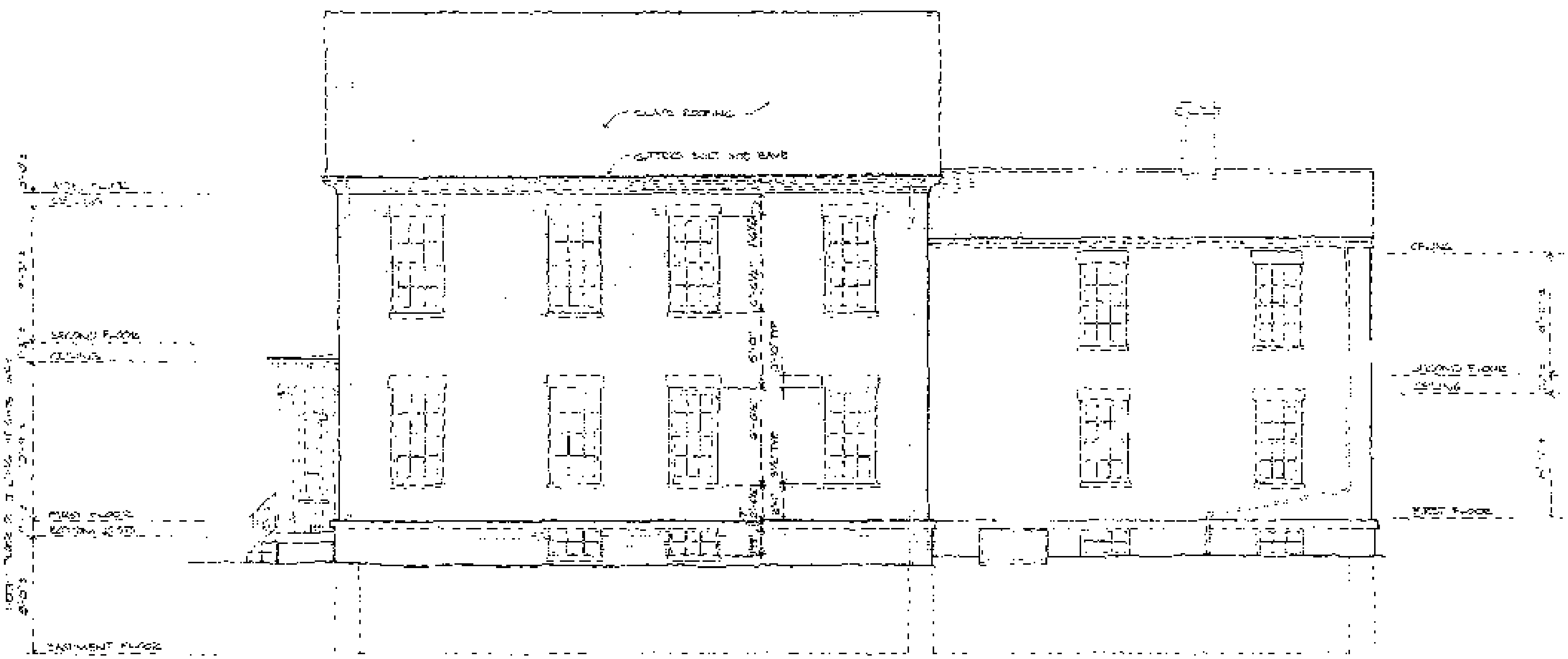
0 1 2 3 4 5 METERS

2/6 REAR ELEVATION (N.E.)
SCALE: 1/4" = 1'-0"

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.

EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED N.J. CARTER	DRAWING NO. 458 28003
DESIGNED WYNA	
DRAWN R.L.C.	SHEET 6 OF 15
CHECKED JULY 1979	
DATE	

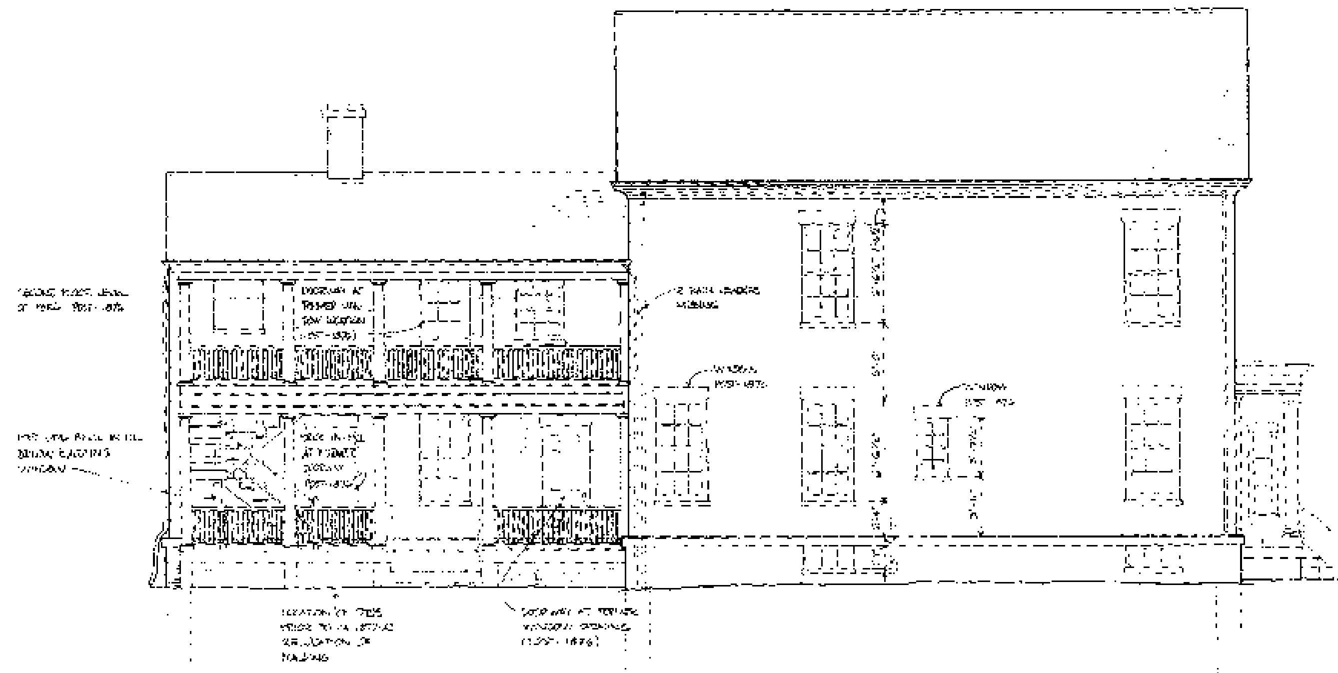


SOUTHEAST ELEVATION
SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET
0 1 2 3 4 5 METERS

MASTER ARMORER'S HOUSE BLDG. 10
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
R.L. CAPER	455 / 20003
DESIGNED	
DRAWN R.L.C.	PKG NO. 102
CHECKED	SHEET 7
JULY 1978 DATE	OF 16



NORTHWEST ELEVATION

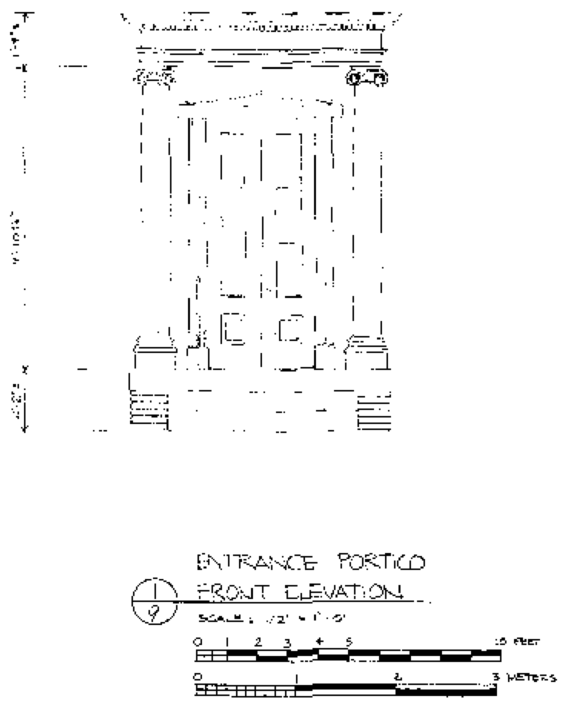
SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET

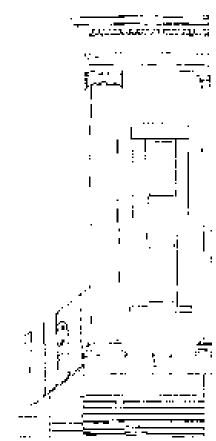
0 1 2 3 4 5 METERS

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.	
R.L. CARPER	458	
DESIGNED WYMA		
DRAWN R.L.C.	PKG NO. 102	SHEET 8
CHECKED JULY 1994 DATE		OF 15



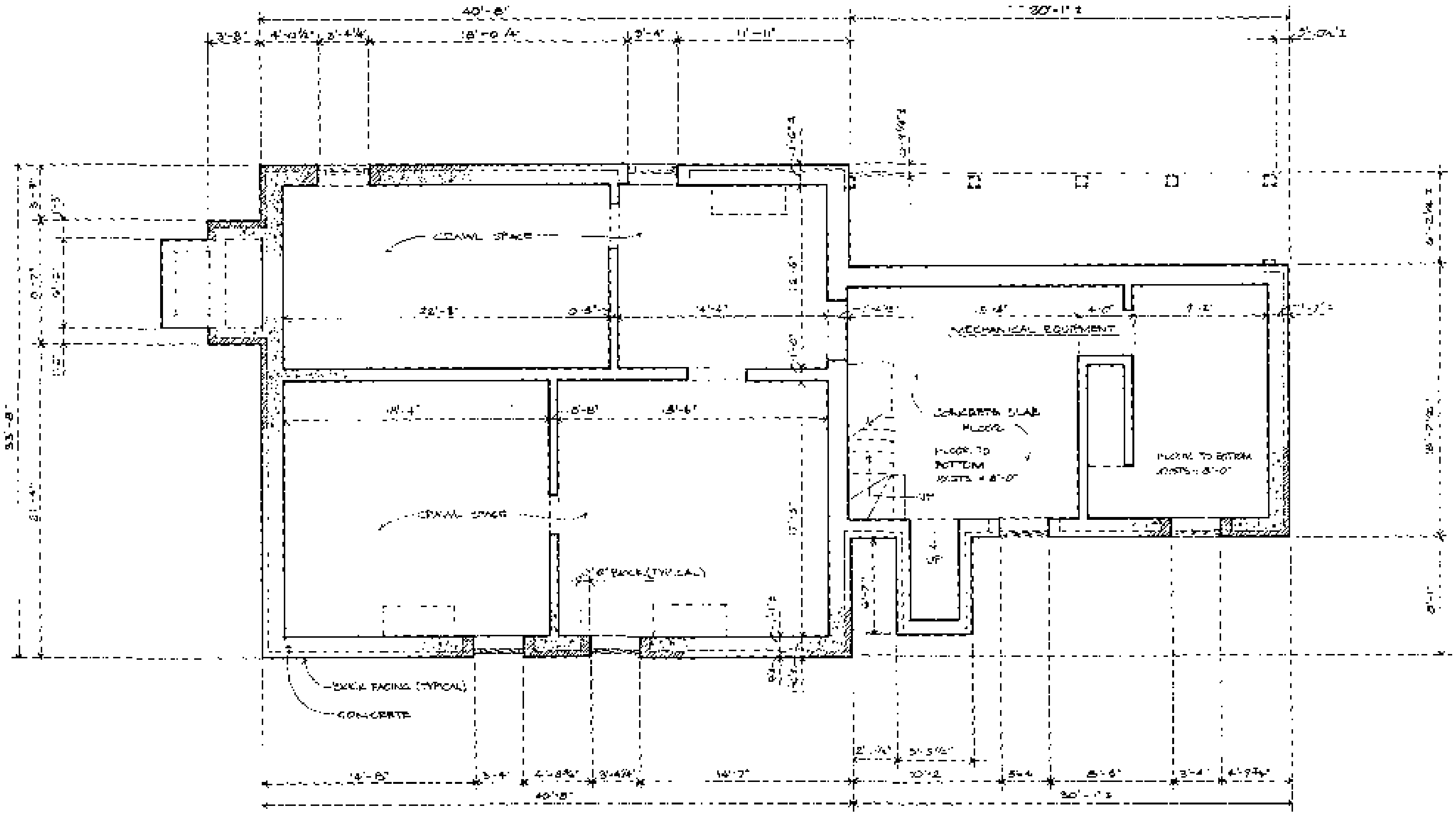
ENTRANCE PORTICO
1/9 FRONT ELEVATION
SCALE: 1/2" = 1'-0"



2/9 SIDE ELEVATION
SCALE: 1/2" = 1'-0"

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
R.L. CASPER	458 / 24003
DESIGNED	
NYMA	
DRAWN	SHEET
R.L.C.	9
CHECKED	
JULY 1978	
DATE	OF 18

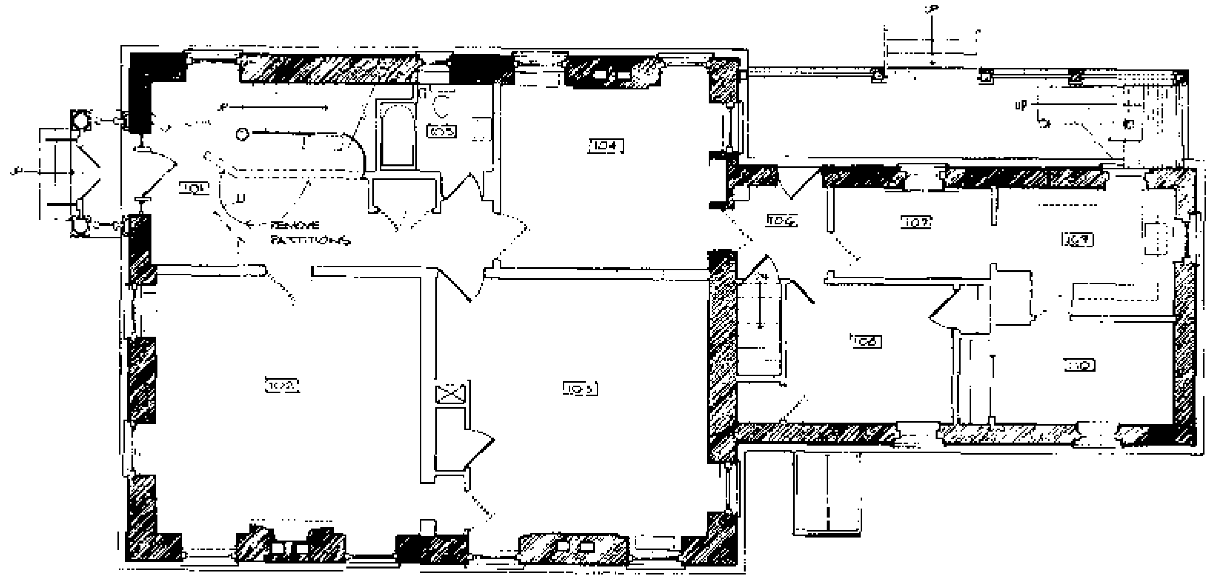


PROPOSED BASEMENT PLAN

SCALE: 1/4" = 1'-0"

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N. H. S.
PROPOSED ADAPTIVE RESTORATION
HISTORIC STRUCTURE REPORT

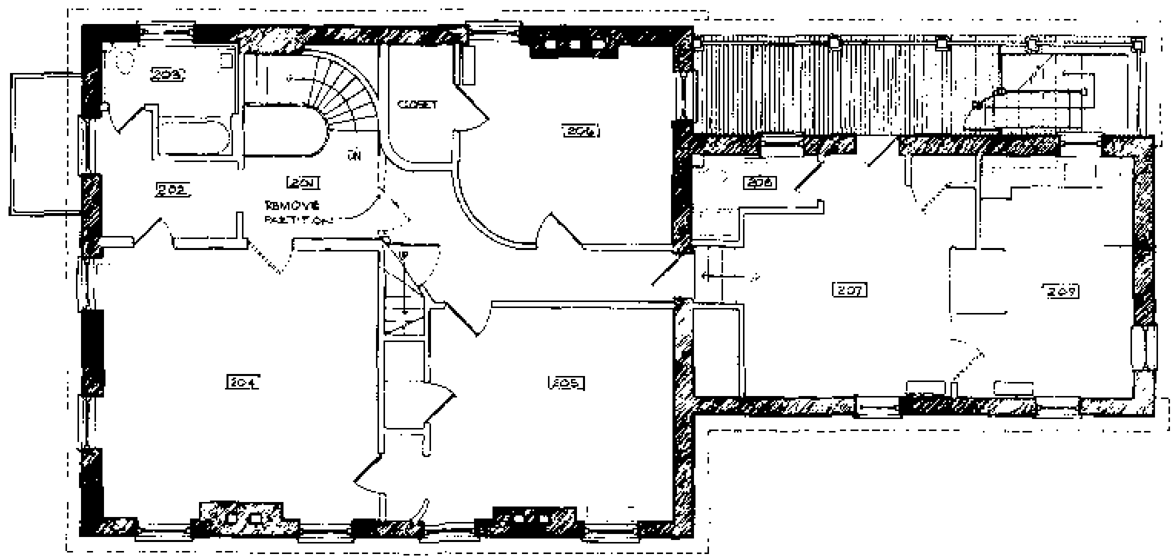
PREPARED R.L. CARPER	DRAWING NO. 458 24005
DESIGNED R.L.C.	
DRAWN R.L.C.	SHEET 1C
CHECKED	
AUG. 1978 DATE	OF 1



FIRST FLOOR PLAN
SCALE: 1/4" = 1'-0"
0 1 2 3 4 5 10 15 FEET
0 1 2 3 4 5 METERS

MASTER ARMORER'S HOUSE BLDG. 10
SPRINGFIELD ARMORY N.H.S.
PROPOSE ADAPTIVE RESTORATION
HISTORIC STRUCTURE REPORT

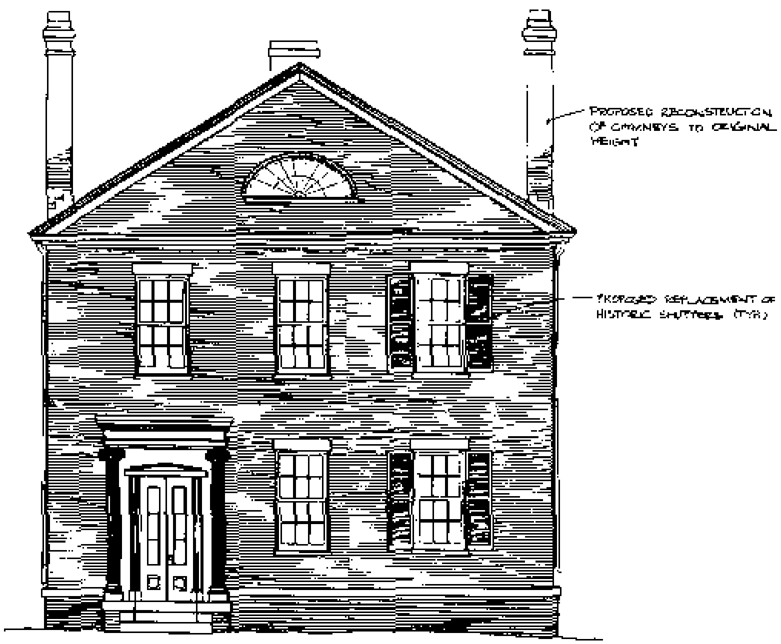
PREPARED	DRAWING NO.
R. L. CARPER	458 / 28003
DESIGNED WYMA	PKG NO. 102
DRAWN R.L.C.	SHEET 11
CHECKED JULY 1978	OF 15
DATE	



1/12 SECOND FLOOR PLAN
SCALE: 1/4" = 1'-0"
0 1 2 3 4 5 10 15 FEET
0 1 2 3 4 5

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
PROPOSED ADAPTIVE RESTORATION
HISTORIC STRUCTURE REPORT

PREPARED R. L. CASPER	DRAWING NO. 456 / 28003
DESIGNED WYMA	SHEET 12
DRAWN R. L. C.	OF 13
CHECKED JULY 1986	

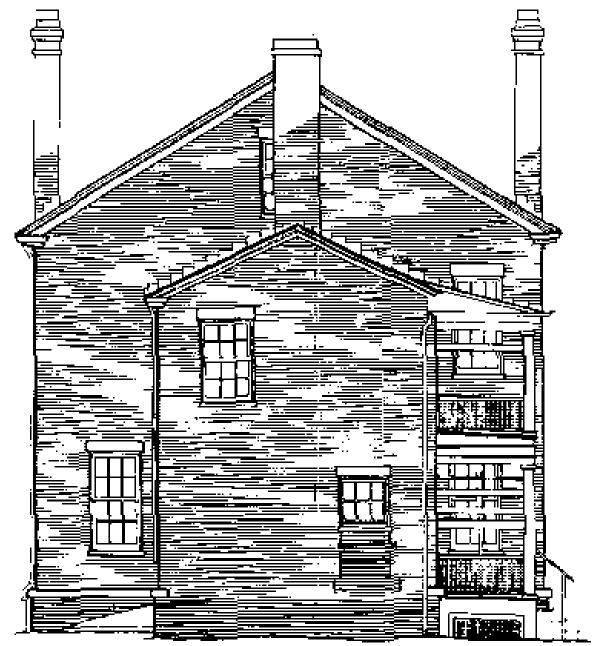


1/13 FRONT ELEVATION

SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET

0 1 2 3 4 5 METERS



2/13 REAR ELEVATION

SCALE: 1/4" = 1'-0"

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
PROPOSED ADAPTIVE RESTORATION
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
R.L. CARPER	458 / 28003
DESIGNED	
DRAWN	PKG NO. 102
CHECKED	SHEET 13
JULY 1976 DATE	OF 15

(1/14) NORTHWEST ELEVATION

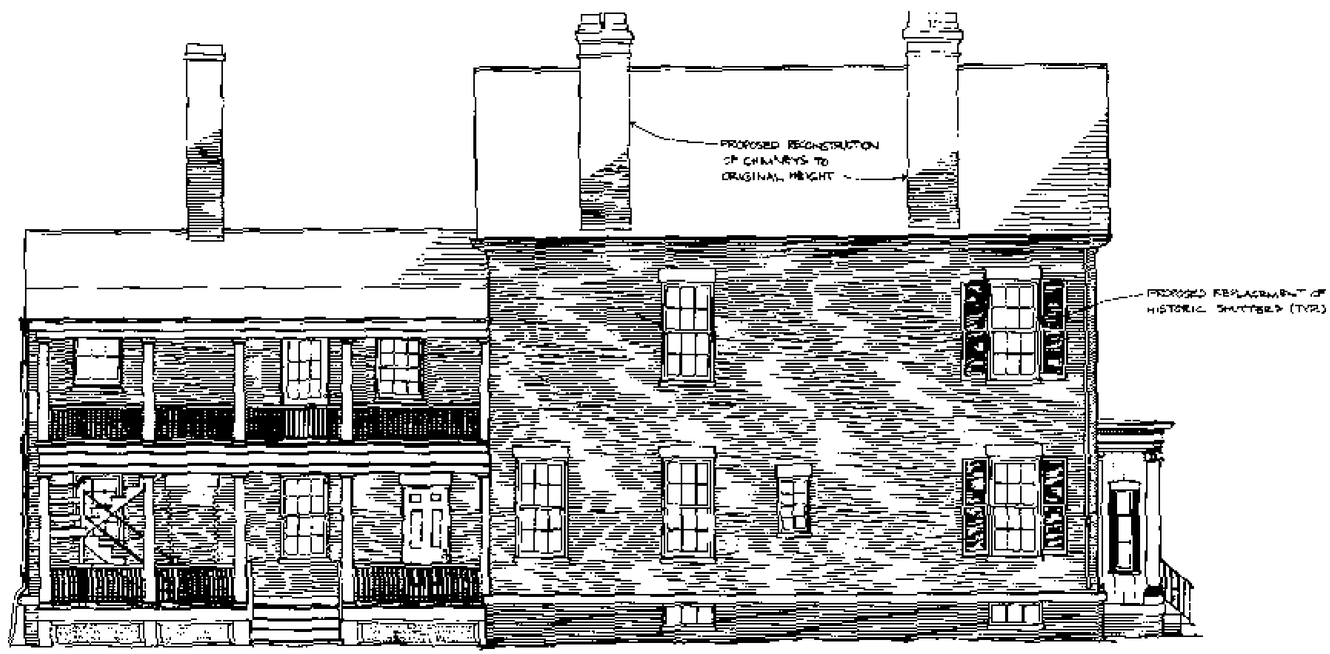
SCALE: 1/4" = 1'-0"

0 1 2 3 4 5 10 15 FEET

0 1 2 3 4 5 METERS

MASTER ARMORER'S HOUSE BLDG. 10
SPRINGFIELD ARMORY N.H.S.
PROPOSED ADAPTIVE RESTORATION
HISTORIC STRUCTURE REPORT

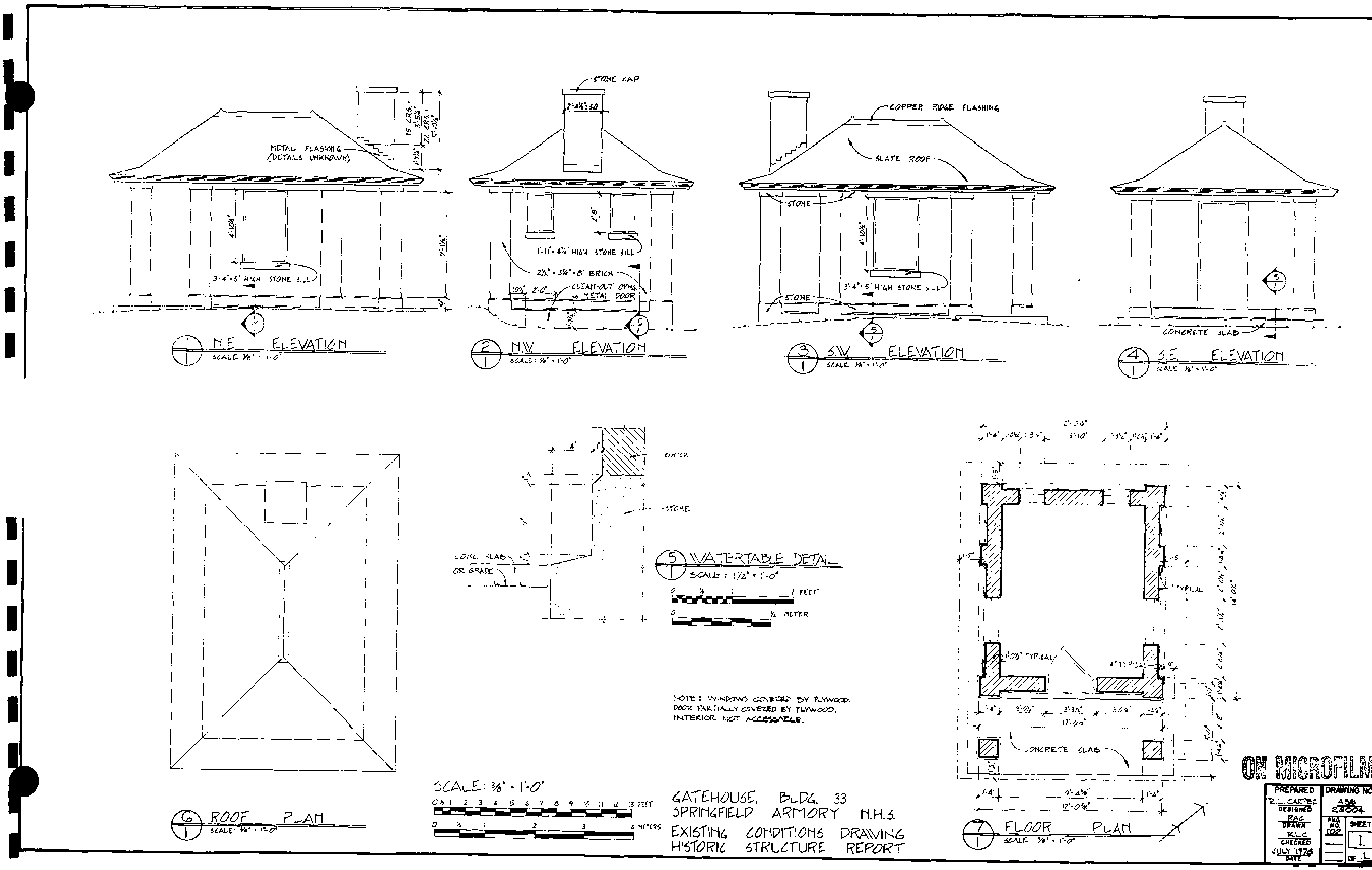
R.L. CARPER	456 / 28005
WYMA	SHEET 14 OF 15
R.L.C.	
JULY 1976	

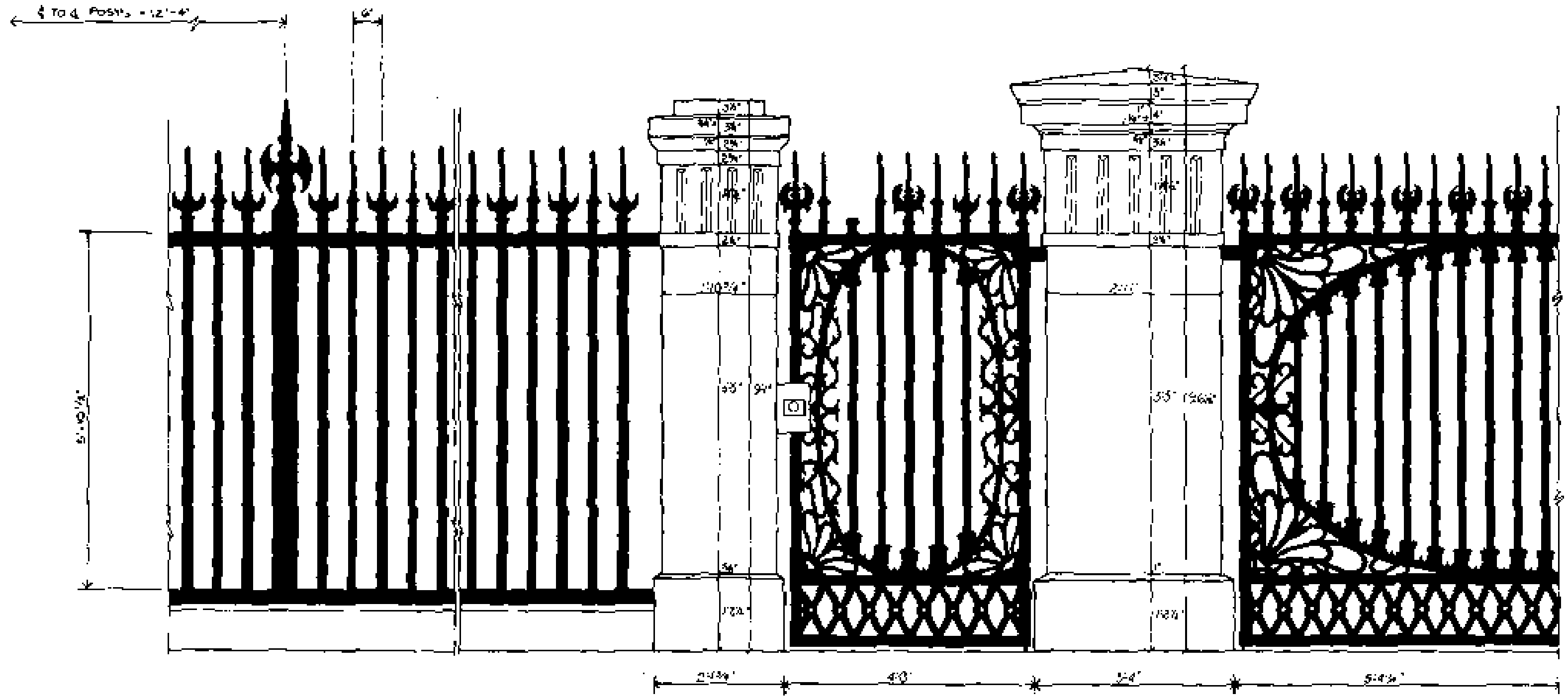


1/15 SOUTHEAST ELEVATION
SCALE: 1/4" = 1'-0"
0 1 2 3 4 5 10 15 FEET
0 1 2 3 4 5 METERS

MASTER ARMORER'S HOUSE, BLDG. 10
SPRINGFIELD ARMORY N.H.S.
PROPOSED ADAPTIVE RESTORATION
HISTORIC STRUCTURE REPORT

PREPARED R.L. CARPER
DESIGNED VAYNA
DRAWN R.L.C.
CHECKED
JULY 1980
DRAWING NO. 456 28003
SHEET 15


STONE CAP
COPPER RIDGE FLASHING
SLATE ROOF
METAL FLASHING (DETAILS UNKNOWN)
3'-4"×5" HIGH STONE SILL
1'-11"×4½" HIGH STONE SILL
2¼"×3⅝"×8" BRICK
CLEAN-OUT OPNG. w/ METAL DOOR
STONE
CONCRETE SLAB
1 N.E. ELEVATION
SCALE 3/8" = 1'-0"
2 N.W. ELEVATION
SCALE 3/8" = 1'-0"
3 S.W. ELEVATION
SCALE 3/8" = 1'-0"
4 S.E. ELEVATION
SCALE 3/8" = 1'-0"
BRICK
STONE
CONC. SLAB OR GRADE
5 WATERTABLE DETAIL
SCALE = 1½" = 1'-0"
1 FEET
½ METER
NOTE: WINDOWS COVERED BY PLYWOOD. DOOR PARTIALLY COVERED BY PLYWOOD. INTERIOR NOT ACCESSIBLE.
6 ROOF PLAN
SCALE 3/8" = 1'-0"
SCALE: 3/8" = 1'-0"
FEET
METERS
7 FLOOR PLAN
SCALE 3/8" = 1'-0"
CONCRETE SLAB
TYPICAL
GATEHOUSE, BLDG. 33
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWING
HISTORIC STRUCTURE REPORT
ON MICROFILM
PREPARED
DESIGNED
DRAWN
CHECKED
JULY 1974
DATE
DRAWING NO.
SHEET
1
OF 1

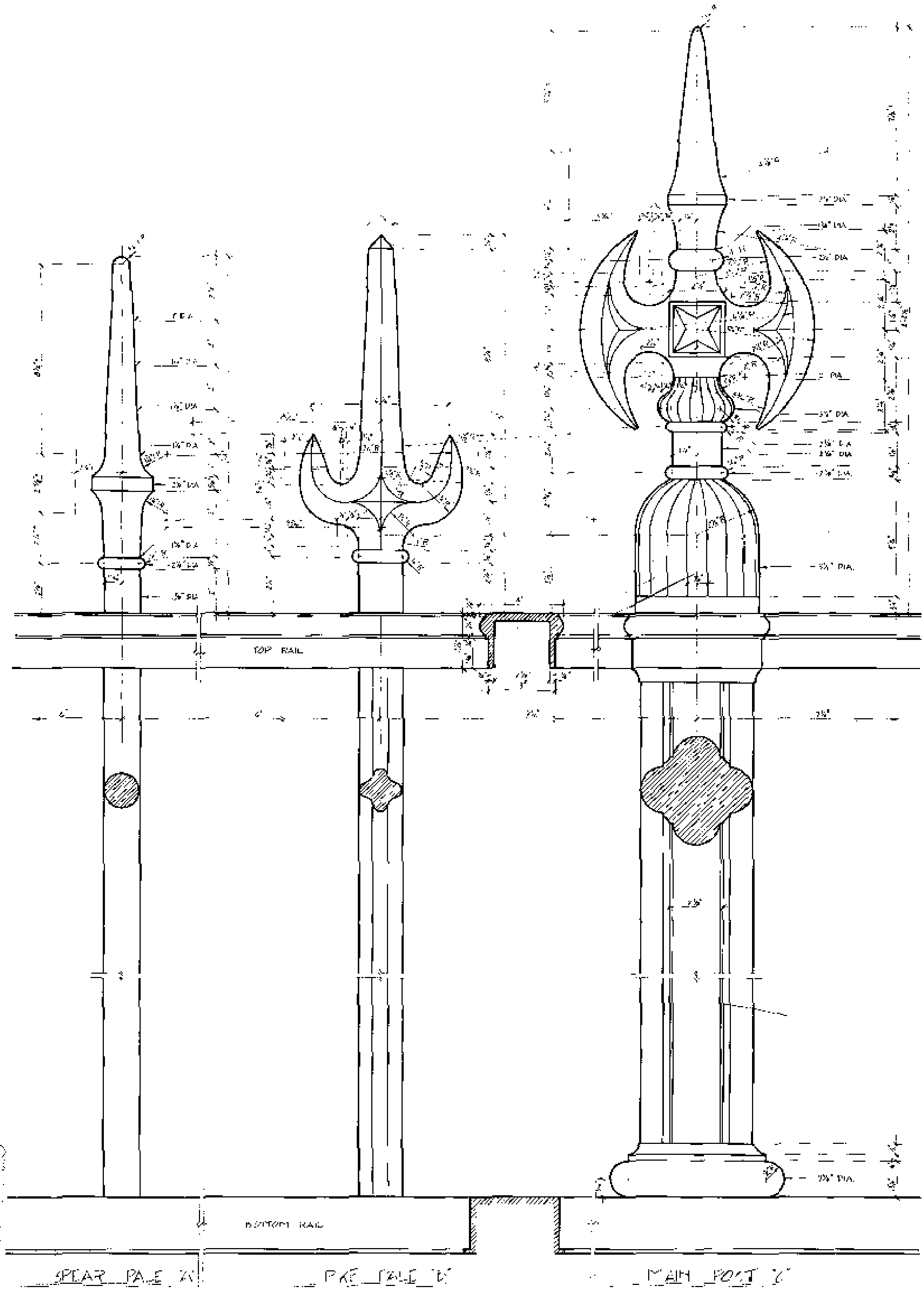


ELEVATION AT STATE STREET ENTRANCE

SCALE: 1" = 1'-0"

FENCE AND GATES
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

PREPARED	DRAWING NO.
CONRAD	458
DESIGNED WYMA	28005
DRAWN CARPER	SHEET 1
CHECKED	
JULY 1976 DATE	OF 2



FENCE
SPRINGFIELD ARMORY N.H.S.
EXISTING CONDITIONS DRAWINGS
HISTORIC STRUCTURE REPORT

FENCE DETAILS
SCALE: FULL SIZE

12 INCHES
CENTIMETERS

PREPARED CONRAD
DESIGNED CONRAD
DRAWN CARNER
CHECKED 1978
DATE

DRAWING NO. 22005
SHEET 2 OF 2

BIBLIOGRAPHY

National Park Service. Environmental Assessment - DCP; Springfield Armory National Historic Site. Denver Service Center, National Park Service, Department of the Interior, Review Copy.

This document discusses many of the issues related to the future development of the park.

Ordnance Department, U. S. Army. Plans of Officer's Quarters at the Arsenals and Armory. Washington, D. C.: Government Printing Office, 1876.

This document contains drawings of Arsenal and Armory structures throughout the United States.

Springfield, Massachusetts. Springfield City Library. Spfd. 670 U58.

This collection, in the local history and genealogy portion of the library, contains a great amount of material, narrative, and graphics.

Springfield, Massachuetts. Springfield Armory National Historic Site.

The files at the site include a potpourri of maps, reports, articles, and over fifty file cabinets of photographs of weapons and weapons testing at the Armory. Material is from U. S. Army Armory files and data gathered from other sources by the Springfield Armory Museum and the National Park Service.

Stull Associates, Inc. and Building Conservation Technology, Inc. Springfield Armory National Historic Site: Material Condition Survey and Recommendations. Denver Service Center, National Park Service (contract), U. S. Department of the Interior, 1979.

_______. _______. Springfield Armory National Historic Site: Paint and Mortar Analysis. Denver Service Center, National Park Service (contract), U. S. Department of the Interior, 1979.

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_______. _______. Springfield Armory National Historic Site: Building Systems Analysis and Recommendations. Denver Service Center, National Park Service (contract), U. S. Department of the Interior, 1979.

_______. _______. Springfield Armory National Historic Site: Building Systems Analysis and Recommendations, Report Update: New Systems. Denver Service Center, National Park Service (contract), U. S. Department of the Interior, 1980.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities to protect and conserve our land and water, energy and minerals, fish and wildlife, parks and recreation areas, and to ensure the wise use of all these resources. The department also has major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

Publication services were provided by the graphics staff of the Denver Service Center. NPS D-5