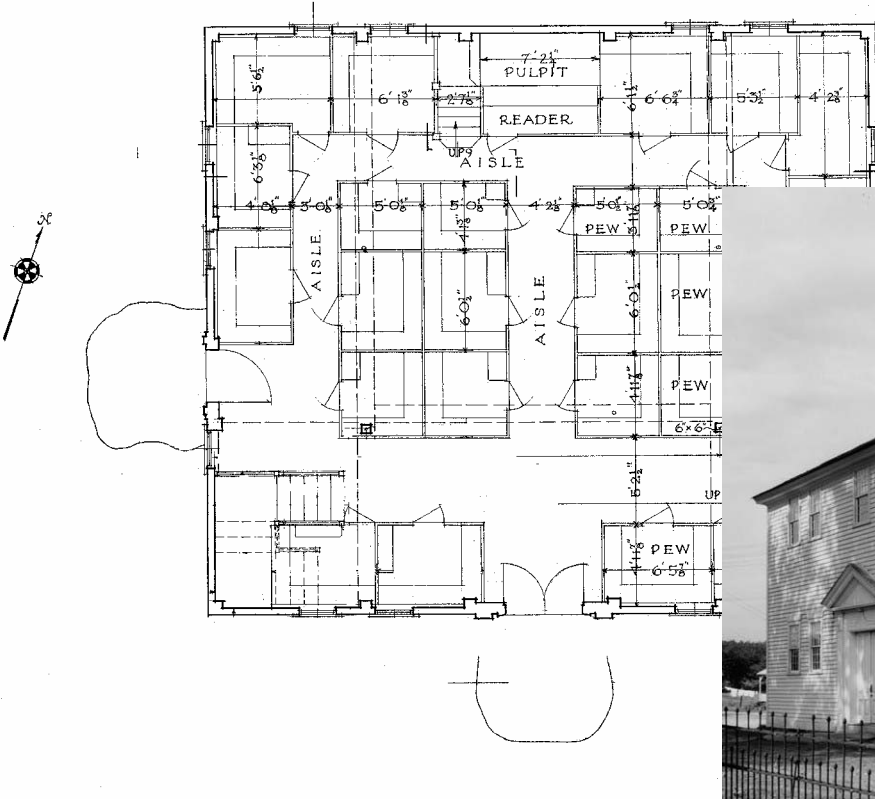


Project Record

Preservation of the Chestnut Hill Meeting House

Millville, Massachusetts

July 17, 2003



John H. Chafee
Blackstone River Valley
 National Heritage Corridor



National Park Service
 Building Conservation Branch

The Chestnut Street Meeting
 House and Cemetery Association



The Commonwealth of Massachusetts
 Massachusetts Preservation Projects Fund

Project Record

CHESTNUT HILL MEETING HOUSE

MILLVILLE · WORCESTER COUNTY
MASSACHUSETTS



Owner:

The Chestnut Street Meeting House
and Cemetery Association
Lincoln E. Barber III, President
Carl R. Wickstrom, Trustee, Local Project Coordinator

Preservation Services:

S. Elizabeth Sasser, AIA
National Park Service
Architectural Preservation Division
Boott Mill Museum, 4th Floor
400 Foot of John Street
Lowell, Massachusetts 01852

Contractor:

Stephen T. Hoyt
Tecumseh Woodworks, Inc.
74 Elmwood Road
South Salem, New York 10590

SECTION III: NARRATIVE DESCRIPTION

The Chestnut Hill Meeting House was constructed in 1769 to serve the south parish in the Town of Mendon and is substantially unaltered from its original construction. The timber-framed structure occupies a 40' x 35'-6" footprint with an approximately 10-foot wide gallery on the east, south, and west sides, and an elaborate pulpit on the north wall. The structure is highly significant for its preserved interior layout and finishes including elaborate and well-preserved *faux* wood-graining. The Meeting-House and adjacent burial ground is owned and managed by the Chestnut Street Meeting House and Cemetery Association, organized under charter of the Massachusetts Legislature on May 15, 1896.

The property is listed in the National Register of Historic Places (11/13/1984), and documented by the Historic American Buildings Survey, call Number: HABS, MASS,14-MILV.V,1- (http://lcweb2.loc.gov/cgi-bin/query/D?hh:3:/temp/~ammem_zBhJ:). The HABS documentation consists of 20 pages of drawings, 12 black and white photographs, and 1 documentation page.

On November 14, 2001, the Chestnut Street Meeting House and Cemetery Association was awarded a matching allocation of \$45,000 by the Massachusetts Historical Commission's Round VIII: Massachusetts Preservation Projects Fund (MPPF), to undertake structural repairs. The MHC originally funded \$45,000, the Association funded \$45,000 from its treasury to match the MHC funds and the Association received separate funding of \$30,000 from the JHCBRVNHCC which was used by the Association for Architectural Supervision costs that were not allowable costs under the MHC grant for an original project cost total of \$120,000. The project included measures to arrest the settlement of the structure, and resultant loss of interior finishes and structural integrity. Specific work included the following:

- In-kind repair of the west elevation sill beam.
- Construction of a concrete pier at the northwest corner of the building.
- Borate treatment of the first floor and gallery floor framing system
- Stabilization and in-kind repair of existing plaster finishes.
- Whitewashing interior plastered surfaces.
- Exterior painting and associated millwork repair/replacement.

As an Affiliated Area of the National Park Service, the Chestnut Hill Meeting House received technical assistance and project support from the National Park Service through the John H. Chafee Blackstone River Valley National Heritage Corridor Commission (JHCBRVNHCC). Services provided by the National Park Service included; architectural investigation, design services, supervision of the construction contract, and project management for the execution of the preservation work funded under the MPPF grant and associated matching funds. These services were provided by the Architectural Preservation Division (formerly Building Conservation Branch) of the National Park Service, Northeast Region.

Stephen T. Hoyt of Tecumseh Woodworks, Inc. served as the General Contractor for the project. The Contract was awarded August 7, 2002, in the amount of \$87,300. A single Change Order for the Project was negotiated and approved September 23, 2002, resulting in a final Contract amount of \$87,788.25. Changes to the Contract were due to a finding that the condition of the floor framing system was better than anticipated, resulting in deletion of perimeter drainage installation from the contract (a credit of \$5,160). The following items were added to the Contract:

- Borate treatment of the entire Gallery floor framing system, pew framing system, and exposed areas of sill and wall framing.
- Selective repair and re-nailing of Gallery flooring.

A final inspection was conducted on November 12, 2002, and the work determined to be substantially complete. Punch list items were identified, but deferred until Spring 2003. Outstanding work, primarily exterior painting, was completed in July 2003.

Repair of West Elevation Sill Beam



Figure 1. View of sill at west elevation showing area of deterioration where the sill rests on the stone step. Exterior trim removed to expose sill.



Figure 2. Deteriorated section of sill removed below west elevation door. Note post tenon at right.



Figure 3. New section of White Oak sill fabricated and ready for installation.



Figure 4. Replacement sill section in place at west elevation doorway.

Construction of Concrete Pier at Northwest Corner



Figure 5. Northwest corner of building excavated to show original stone footing.



Figure 6. Northwest corner of building showing concrete formwork prior to placement of concrete footing.



Figure 7. Finished concrete footing in place at northwest corner of building.

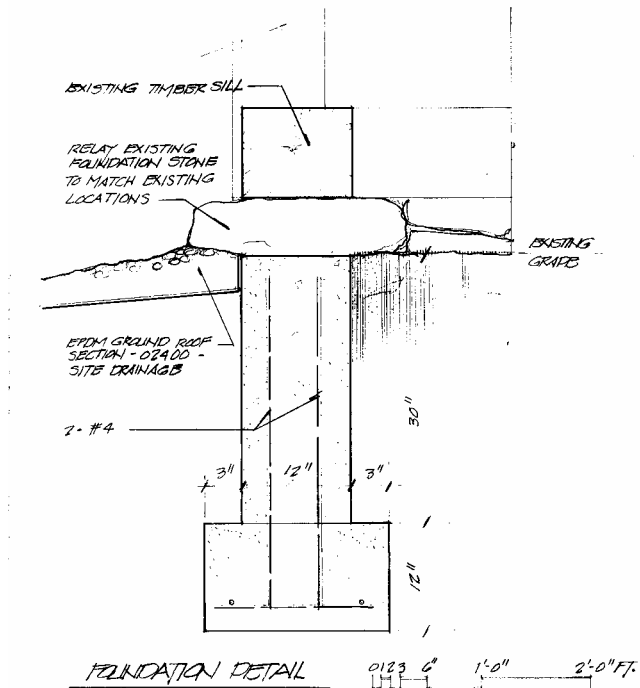


Figure 8. The original footing detail was modified based on field conditions to surround and buttress the existing stable stone base.

Borate treatment of the first floor and gallery floor framing system



Figure 9. Worker accessing subfloor crawl space. The existing floor framing was found to be in remarkable sound condition.



Figure 10 & 11. Before and after photographs showing subfloor and finished floor reinstated after borate treatment.

Stabilization and in-kind repair of existing plaster finishes

This portion of the project consisted of evaluating the condition of existing interior plaster; patching and repairing areas of removed or damaged plaster; repair of cracks larger than hairline; consolidation of loose or poorly keyed plaster; and application of a scratch, float, or setting coat, where required, to restore and preserve wall and ceiling surfaces to a compatible and sound finish condition. The method used for consolidation was based on Phillips, Morgan, "Experiences in the Use of Acrylic Plaster Adhesives," *Case Studies in the Conservation of Stone and Wall Paintings, Preprints of the Contributions to the Bologna Congress, 21-26 September 1986*, ed.s N.S. Brommelle and Perry Smith, International Institute for Conservation, London, p. 34-37.



Figure 12. Joaquim da Fonseca preparing plaster consolidant materials.

Plaster Consolidation Specification

DESCRIPTION:

- A. The Chestnut Hill Meeting House is listed in the National Register of Historic Places (11/13/1984), and documented by the Historic American Buildings Survey, call Number: HABS, MASS,14-MILV.V,1- (<http://memory.loc.gov/ammem/hhhtml/hhhome.html>). The Chestnut Hill Meeting House was constructed in 1769 to serve the south parish in the Town of Mendon and is one of the best preserved eighteenth century meeting houses in New England. All work will take place within a significant historic structure, and will be completed in such a way as to protect existing architectural features from damage and to retain as much historic fabric as possible, with a minimum of loss.
- B. The work of this section consists of evaluating the condition of existing interior plaster; patching and repairing areas of removed or damaged plaster; repair of cracks larger than hairline; consolidation of loose or poorly keyed plaster; and application of a scratch, float, or setting coat, where required, to restore and preserve wall and ceiling surfaces to a compatible and sound finish condition.
- C. The scope of work includes interior walls and the underside of the gallery.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Section - 01300: Submittals
- B. Section – 09910 – Interior Finishes (Limewash)

1.3 COORDINATION: Coordinate work of this section with work of other sections to avoid job delay.

1.4 QUALITY ASSURANCE:

- A. Standards: American Society for Testing and Materials (ASTM) and manufacturer's printed recommendations.
- B. Repair determinations will be coordinated with the Owner's Representative, an NPS Architectural Conservator, and the Contractor regarding the extent of repairs and/or treatments.
- C. Qualifications of Contractor: Must be experienced in all phases of historic plaster repair, specifically the preservation, repair, and reproduction of lime based plasters. The contractor must have six years and/or four projects of similar historical significance.

1.5 REFERENCES:

- A. Appendix A: Phillips, Morgan, "Experiences in the Use of Acrylic Plaster Adhesives," *Case Studies in the Conservation of Stone and Wall Paintings, Preprints of the Bologna Congress, 21-26 September 1986*, ed.s N.S. Brommelle and Perry Smith, International Institute for Conservation, London, p. 34-37. Note: Where variances exist between the materials and procedures described in the article vary from those of the specifications, the specifications shall govern.

1.6 SUBMITTALS: In accordance with Section 01300:

- A. Submit written repair procedures to Owner's Representative for approval prior to commencement of work.
- B. Submit Material Safety Data Sheets for plaster consolidation materials.

- C. If requested, furnish affidavits from manufacturers certifying materials and products delivered meet requirements specified.

1.7 **PRODUCT HANDLING:** Deliver materials in manufacturer's original, unopened protective packaging. Store materials in a dry place, as directed by Owner's Representative, off the ground, under cover which permits air circulation, to prevent damage and intrusion of water or foreign matter.

1.8 **JOB CONDITIONS:**

- A. Protect and cover all adjacent architectural features and work completed by other trades.
- B. Determine what substrates to which plaster materials are to be applied are sound and free from defects affecting proper application of the lime plaster. Report defective surfaces to The Owner's Representative.
- C. Insure that a minimum temperature of 65 degrees F, is maintained for an adequate period prior to, during and after application of plaster and that heating and/or ventilation is supplied and properly regulated to insure the safety of the structure and its contents, and the correct curing of the lime plaster.

PART 2 **MATERIALS**

2.1 **Plaster Consolidation Materials**

A. **General**

- 1. Available from Conservators Emporium, 100 Standing Rock Circle, Reno, NV 89511 (775) 852-0404, FAX (775) 852-3737, www.consemp.com:
 - a. Rohm and Haas, Rhoplex MC-76
 - b. Rohm and Haas, Rhoplex 1950
 - c. Rohm and Haas, Acrysol ASE-60
 - d. Fluid liquid coke
 - e. Glass Microballoons
- 2. Available from Fisher Chemical, 711 Forbes Avenue, Pittsburgh, PA, 15219; (800) 766-6000, FAX (800) 926-1166, www.fishersci.com:
 - a. Ammonium Hydroxide (28% NH₃)*
 - b. Isopropanol (laboratory grade)

B. **Prewet Solution:**

5 parts water (by volume)
1 part Isopropanol
2 parts Rhoplex MC-76

C. **Adhesive:**

A 3:2 mixture of Rhoplex MC-76 to Rhoplex 1950 is used for plaster on lath. If plaster on a masonry substrate is being adhered, MC-76 alone can be used.

D. **Thickener:**

2 ½ quarts water
2 cups Acrysol ASE 60

¼ cup ammonia hydroxide

E. Unfilled adhesive:

4 cups Microballoons

4 cups lime

8 cups Rhoplex mix (3:2 MC-76: 1950 for wood lath, MC-76 alone for masonry.)

1 cup water

½ cup thickener (add until proper consistency is reached)

F. Filled adhesive:

4 cups Microballoons

4 cups lime

4 cups coke

8 cups Rhoplex mix (3:2 MC-76: 1950 for wood lath, MC-76 alone for masonry.)

1 cup water

½ cup thickener (add until proper consistency is reached)

2.2 Plaster mixes for application on lath, metal or wood

A. Basecoat Plasters (course stuff), for application on lath, metal or wood

Mix lime putty, 1:3, with sand, for the scratch coat, well haired

Mix lime putty, 1:2.0-2.5, with sand, for the float coat, haired

OR: formulate according to mortar analysis

B. Finish coat Plasters or small area, crack repair

Mix lime putty, 1:1, with graded sand, for the finish coat,

OR;

Mix lime putty, 3:1, with gauging plaster

OR;

Mix according to mortar analysis, with the approval of the Owner's Representative.

2.3 Gauging Plaster: USG Champion Quality Gauging Plaster, or equal.

2.4 Lime: ASTM C-207, Type S, fresh hydrated finish lime, OR prepared lime putty, Virginia Limeworks, P.O., Box 516. Monroe, VA 24574. (434) 929-8113. Fax: (434) 929-8114, <http://www.valimeworks.com/Main.htm>, or approved equal.

2.5 Sand: ASTM C-897, well graded, masons sand. Clean and free of dirt, and organic substances. Or match the existing historic sand as determined by the Owner's Representative and the mortar analysis.

2.6 Fiber for Scratch and Float coats: The fiber should be 1" to 1/2", in length. It shall be added in the proportion of 1/2 pound of fiber to 2.25 cubic feet of course stuff. Preservation Resource Group, Inc. PO Box 1768, Rockville, MD 20849-1769. (301) 329-2222. Fax: (301) <http://www.prginc.com/prod-index/index.html>, or equal.

2.7 Water shall be clean, fresh, potable, and free from organic substances.

2.8 Bonding agents, are not recommended and are not to be used without specific written permission from the Owner's Representative, and used in accordance manufacturers instructions.

2.9 Metal Lath, (not for application on sound exposed wood lath)

- A. Galvanized steel expanded (diamond) mesh lath if needed.
- B. Tie wire: 18 ga. galvanized soft annealed wire.

2.10 Fasteners:

- A. For wood lath to wood framing, stainless steel, ring shank siding nails.
- B. For metal lath to wood framing, galvanized or stainless steel bugle head deck screws
- C. Plaster washers: galvanized metal, Charles Street Supply Co.54 Charles St. Boston, MA 02114 617/367-9046 <http://www.charlesstsupply.com/> , or approved equal.

PART 3 EXECUTION

3.1 Evaluation of plaster condition: The Contractor shall conduct an evaluation, and in conjunction with the Owner's Representative and an NPS Architectural Conservator, determine the extent of the damage and evaluate work requirements and causes before proceeding. Test suspect plaster surfaces by tapping to locate hollow sounding areas. Gently press the plaster surface with palm of hand or with a T-brace made from 2x4s; If plaster moves in relation to the studs and lath, then the keys are broken; With more pressure, a similar movement indicates that the plaster is well keyed to the lath, but the lath is loose from the studs.

3.2 Patch Repair of areas of missing plaster

- A. Evaluate the soundness of contemporary patch repairs and remove if necessary.
- B. At exposed wood lath, re-secure to existing framing with stainless steel nails or pre-drill holes for screw attachment. Clean out keys and vacuum clean.
- C. Re-attach perimeter of sound plaster with conservation adhesive if necessary, and allow to coalesce as necessary.
- D. Rake perimeter of hole, and cut back, for replacement plaster to tuck in behind the existing plaster.
- E. Replace missing wood lath with similar materials, if necessary bridge gaps in the wood lath with expanded metal lath, overlapping the existing wood lath by a distance of not less than 6 inches, attaching with deck screws and plaster washers.
- F. Remove dust and debris from surfaces to receive repair, and dampen wood lath and adjacent plaster edges; using a mix of water and non-detergent surfactant.
- G. Large area repair, adhere the perimeter of the opening and fill with two to three layers of the lime/sand/hair basecoat plaster, no more than 3/8" per coat, and a finish coat, flush with the surrounding surfaces. The first coat should be scratched to receive the straightening coat. Allow the scratch coat to cure thoroughly. Mist as required to prevent the plaster from curing too quickly. Thoroughly mist the first coat before applying your second coat to control suction. The second coat should be applied, floated as required and allowed to set to thumbprint hardness before keying the surface to receive the finish coat. Allow the second coat to cure thoroughly before applying the finish coat.
- H. Small area repair, two inches or less, fill with crack fill material, flush with the surrounding surfaces.

3.3 Crack Repairs (larger than hairline)

- A. Rake cracks out in an inverted "V", in general 1" to 1/2" in width, up to the entire depth of the existing plaster.
 - B. Remove dust and debris from surfaces to receive repair, and dampen wood lath and adjacent plaster edges; using a mix of water and non-detergent surfactant.
 - C. Fill with non sanded finish coat material, flush with the surrounding surfaces.
- 3.4 Re-attachment/reinforcement of poorly secured lath: Use plaster washers to pull plaster and lath back to the studs or joists. Locate and mark framing locations (studs/post/joists), Secure with 1-1/2 to 2 inch stainless steel deck screws fitted with plaster washers. Space every 4 inches on framing members where sagging is apparent. Tighten screws gradually to avoid damage to sound plaster. Patch the holes with crack repair material and finish flush with adjacent plaster surfaces.

3.5 Consolidation of Plaster by Injected Adhesive Bonding

A. Materials Preparation

1. Prewet solution: See Section 2.1.B. May be mixed ahead of time and stored in a covered container
2. Adhesive: See Section 2.1.C. May be mixed ahead of time and stored in a sealed container.
3. Thickener: Section 2.1.D. May be mixed ahead of time and stored in a covered container. Mixing should be done in a well-ventilated area, and a respirator with ammonium fume cartridges should be worn by the worker. Mix the thickener by hand and not mechanically.
4. Unfilled adhesive, Section 2.1.E. Where the space between the lath and plaster is less than about 3mm (1/8"), the unfilled formulation is used
 - a. Measuring must be done using accurately sized vessels that can be screeded level at the top. To permit injection through 5mm (1/4") holes, the fillers should be passed through window screening (approximately 50 holes per cm²), and a methodical mixing procedure established. The powders should be premixed together after screening in the dry state to insure against formation of lumps in the lime. A particle mask must be worn when while mixing the dry fillers.
 - b. Place the Microballoons in the mixing container first, followed by the lime and premix. Premix the liquids, and sift in the dry powders while stirring vigorously until all lumps are eliminated. A 2-3/4 inch mixing propeller in a high speed drill may be used for both wet and dry mixing.
 - c. The fillers for each batch of adhesive must be measured separately in two parts for each of the fillers to avoid compaction, resulting in excess filler proportioning.
 - d. Add thickener to the adhesive mixture until a thick, but injectable consistency is reached.
 - e. The unfilled adhesive may be mixed ahead of time and stored in a covered container.
 - f. Refer to Appendix A for additional information on procedures and controls for proportioning and mixing.
5. Filled adhesive, Section 2.1.F. Used where gaps exist between the lath and plaster up to 2cm (3/4").
 - a. Prior to mixing, oven-dry the fluid coke. Although heating schedules may vary, a 50mm (approx. 2 inch thick layer in a pan should be dry after 2 hours in an oven at 150 degrees C. Allow the coke to cool before mixing. If the ambient relative humidity is greater than 30%, store the coke in sealed containers after drying.
 - b. Measuring must be done using accurately sized vessels that can be screeded level at the top. To permit injection through 5mm (1/4") holes, all three fillers should be passed through window screening (approximately 50 holes per cm²), and a methodical mixing procedure established.

The powders should be premixed together after screening in the dry state to insure against formation of lumps in the lime. A particle mask must be worn when while mixing the dry fillers.

- c. Place the Microballoons in the mixing container first, followed by the lime and coke, and premix. Premix the liquids, and sift in the dry powders while stirring vigorously until all lumps are eliminated. A 2-3/4 inch mixing propeller in a high speed drill may be used for both wet and dry mixing.
- d. The fillers for each batch of adhesive must be measured separately in two parts for each of the three fillers to avoid compaction, resulting in excess filler proportioning.
- e. Add thickener to the adhesive mixture until a thick, but injectable consistency is reached.
- f. The filled adhesive should be used within 45 minutes after mixing.
- g. Refer to Appendix A for additional information on procedures and controls for proportioning and mixing.

3.6 Plaster Preparation and Injection

- A. Drill holes through the plaster 3-6 inches apart, using a 1/4 inch masonry bit, where plaster keys are missing or loose.
- B. Vacuum injection sites and use a bent wire tool if necessary to dislodge loose plaster particles. Thorough vacuuming is essential to remove all loose sand and fines from the plaster surfaces to allow good bonding of the adhesive. It may be necessary to fabricate special nozzle attachments for the vacuum to thoroughly clean injection holes.
- C. Prewet the injection holes and gaps at the edges of lost plaster with the prewet formula using a syringe with large gauge needles, or handheld sprayers.
- D. Apply the adhesive using bulk-loading caulk guns with 3/8"-1/4" diameter tips made from threaded plumbing fixtures or welded metal tubing.
- E. Use flexible rubber tubing to inject the adhesive into open areas at the edges of sections of lost plaster.
- F. After injection, stabilize plaster as required with screws and plaster washers, or brace with styrofoam faced plywood and dimension lumber braces.
- G. Clean injection points of excess adhesive while wet, using steel spatulas and damp rags.
- H. After the consolidant has cured remove braces, and patch plaster washer locations with crack repair material and finish flush with adjacent plaster surfaces.

3.7 Adjusting/Cleaning

- A. Remove all rubbish and debris caused by plastering work.
- B. Clean all affected surfaces of room and furnishings to their prior condition.



Figure 13 & 14. Joe Serra cleaning and pre-wetting areas of damaged plaster prior to consolidation.



Figure 15. Plaster repairs following consolidation.



Figure 16.. Filling stabilized cracks in plaster. Note plaster washers along lines of stabilized cracks.



Figure 17. Plasterer Frank. J. Mangione of Saugerties, NY completing interior plaster repair.

Whitewashing interior plastered surfaces



Figure 18. Completing interior whitewashing.



Figure 19. Interior whitewashing showing "windows" to preserve historic wall inscriptions.

Exterior painting and associated millwork repair/replacement



Figure 20. Exterior millwork replair



Figure 21. Exterior painting using bucket truck.

Completed Project Exterior Photographs



Figure 22. View from southwest.



Figure 23. View from northeast.

Completed Project Interior Photographs



Figure 24. Interior view looking southwest.



Figure 25. Interior view looking northeast.

Archaeological Artifact: Cataloging and Inventory



Figure 26. Archaeological artifacts with inventory. See attached.