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Specifications for Structural Repairs to the Keeper's Workshop at the Cape Neddick Light Station

Deember, 2016

Introduction

This specification, prepared by Scott Stevens and Steven Mallory of Groundroot Preservation Group, LLC, responds to the need for immediate stabilization and repair of the Keeper's Workshop, an ancillary structure that is part of a collection of associated buildings known as the Cape Neddick Light Station in York Beach, Maine. After being decommissioned by the U.S. Coast Guard, the Town of York assumed ownership and care of the buildings in 1997.

The Keeper's Workshop is a wood-framed structure dating to the third quarter of the nineteenth century, and was the second structure constructed on the site. It is a hybrid structure, exhibiting both timber-framed and balloon-framed details in its construction. It rests upon a system of masonry peers rather than a full foundation.

Today, the building exhibits significant preservation issues. Settling over time has caused it to sag and go out of level. Chronic leaking has led to advanced decay on the north elevation, particularly in framing areas surrounding the window on this elevation. Many stop-gap repairs have been executed over the years such as installation of expandable spray-foam insulation to halt water infiltration.

The frequently harsh weather conditions on the exposed site leads to a relatively short lifespan for building materials such as wooden clapboards, window glazing, paint and roof coverings. The saline environment causes ferrous-metal components such as nails, screws and other hardware to corrode prematurely.

This document describes methods for repairs to the building's framing components, underpinnings, wooden finishes and windows. Specifications for treatment of ferrous-metal items and paint finishes can be found in a separate paint specification report prepared for the Cape Neddick Light Station at large by Groundroot Preservation Group in August of 2016.

Part 1: General

- a. Contractor Selection: contractors for carpentry work will have:
 - a. At least five years of experience working with structures listed in the National Register of Historic Places.

- b. At least five years of experience with the tools, techniques and skills associated with restoration carpentry.
- b. Quality Assurance
 - i. All processes and procedures will be subject to inspection and approval by employees of the Town of York's Parks and Recreation Department ("YPR") or its designated a representative.
 - ii. All work will be completed in a neat, clean and workmanlike manner.
- c. Certification and Compliance
 - i. All workman will possess the requisite licensing, insurance and certification (particularly regarding EPA regulations for potential disturbance of lead paint)
 - ii. All local regulations or ordinances regarding scaffolding, parking, public streets, right-of-way, and noise levels will be observed.
- d. Documentation
 - a. Contractor will document with photographs all conditions before treatment, and during and after each procedure, to be submitted YPR.
 - b. A brief report will be submitted to the YPR by the Contractor at the end of the project describing the final scope of work and treatment methods used.
- e. Removals
 - a. All damaged materials, including those that require replacement and those requiring repair, will be carefully pried loose using a flat, thin prying tool such as a 9 1/2" example made by the Hyde Tool Company.
 - b. Care will be taken to use gentle pressure to pry near the fastening nails, breaking the purchase of the nails from the substrate.
 - c. All nails that will not extract with low-to-medium hand pressure, or without potentially cracking or breaking the wood, will be cut from behind with a hand-held hack saw blade or a reciprocating saw such as a Fein® saw fitted with a metal-cutting blade.
 - d. If using a power saw of any kind, care will be taken to cut slowly and in short increments. The purpose of this is not to heat the nail to the point where it may ignite surrounding wood.
- f. Salvage and Disposition
 - a. Examples of each element considered "unsalvageable", but determined to be original or a component of the historic fabric will be labeled and retained in the building for future reference.
 - b. To the extent possible, a minimum of twelve linear inches of each profile will be retained.
 - c. Each archived component will be clearly labeled in black permanent marker with its original location and the date of removal; for example, "Original trim element removed from west end of south elevation, May 2017."
 - d. YPR staff will determine the final place of disposition for such elements.

g. Salvageable vs. Unsalvageable Elements

- a. An element will be considered “salvageable” if:
 - i. it is a major architectural component such as a frieze, corner board, clapboard or other trim element; or it is an original underlayment material such as sheathing, and...
 - ii. Is determined to be an original or historical component
 - iii. Exhibits structural integrity, meaning that decay is limited only to end-gran checking and isolated minor areas of decay penetrating ½” or less into the material.
 1. More than 75% of the element is sound.
 2. “Sound” is defined as wood that will not allow more than 1/8” penetration with a sharp probe, such as a carpenter’s scratch awl applied perpendicularly to any plane and pushed using moderate hand pressure.
 3. For clapboards, if the material survives careful removal in a crack-free state.
- b. An element will be considered “unsalvageable” if:
 - i. It is not original or part of the historic evolution of the building...
 - ii. ...and/or it exhibits extensive decay, loss of profile or dimension...
 - iii. ...or is a secondary/sacrificial component such as a later or badly damaged clapboard.
- c. An element can be repaired using a Dutchmen or graft only if greater than 75% of it is otherwise sound. For example, a decayed section of corner board can be cut out and replaced if three feet or less of a twelve-foot length is damaged. If more than 25% of the element is damaged, consider full replacement.

Part 2: Project Specifications

The following entries include specifications for site work and drainage, underpinnings, framing repairs, and repairs of sheathing and windows. All procedures described below are in keeping with current, accepted historic preservation standards, namely the Secretary of the Interior’s Standards and Guideline’s for the Treatment of Historic Buildings.

The items listed below should be completed in the order in which they appear in this document.

A. Site-work: Landscape and Drainage

The overall site topography and placement of the building on the landscape naturally lend themselves to drainage toward the building from the east and north. The landscape to the west and south are generally more flat. However, settling of the building’s footings and the inevitable buildup of topsoil over time have caused grade to encroach on the building on the south and west elevations. This is a problem particularly on the west elevation.

We recommend reducing the grade along the south and west elevations to at least ten inches below the bottom plane of the building’s sills. If bedrock outcroppings are exposed in the process, these should be left as-is and all soil around them removed accordingly. The grade

should slope away from the foundation at a 2% pitch, or at least be level for a minimum of eight feet from it.

On the east and north sides of the building, grade should also be lowered to a minimum of ten inches below the bottom plane of the building's sills. On the east elevation, grade should be made flat in an east-west direction for a minimum of six feet from the building, but sloping to the south with a minimum of 2% grade, to promote drainage to the south and away from the building. On the north elevation, grade should be reduced to a minimum of ten inches below the bottom planes of the building's sills and made level in a north-south direction for a minimum of four feet from the building, but sloping to the west at a minimum of 2% pitch to promote active drainage away from the building. All of the above grade adjustments assume leaving any existing or uncovered rock outcroppings unaltered.

Following grade adjustments, splash stones should be installed along the north and south elevation. These should be installed in a band a minimum of 18 inches wide. The material should be local beach gravel, consisting of round stones averaging one inch in diameter.

B. Light and Air Circulation

The building does not get adequate air circulation or exposure to daylight on the north elevation, largely because of close-by vegetative overgrowth. We recommend that all plantings be cut back to a minimum of ten feet from the building, and that grass and weeds be kept cut back during summer months.

C. Ventilation

As designed, the building's situation on piers rather than a full foundation promotes optimum ventilation. However, encroachment of topsoil and vegetation on the west, north and south sides prevents adequate airflow beneath the building. Grade adjustments discussed above will correct this situation.

- A. D. Jacking and Leveling- Temporary Access for Repairs, and Returning Building to Level:
- B. If contractors require that the building be raised in order to gain access to the sills and bottom portions of posts and studs for repairs, the building must be temporarily raised.
- C. Temporary horizontal wooden members should be passed through the crawl area below the building, to which jacks can engage.
 - a. Temporary wooden members will consist of pressure-treated 6" x 6" timbers.
 - b. They will be installed in a north-south direction, extending outward past the north and south facades by no more than 24".
 - c. A system of four such timbers will be installed, evenly spaced, and with the eastern and westernmost timbers placed inward of the gable-end sills by 12".
 - d. The four main timbers will be connected by pressure-treated 2"x 6" planks, fastened to the bottom faces of the timbers, and running parallel to the north and south elevations of the building.

1. Remove all exterior trim elements and/or siding that impede direct contact between the temporary members and the sills
 2. Use lag bolts of a minimum diameter of 3/8" to attach members to the building.
 3. Only attach lags to sound material.
- ii. Upon lowering the building onto piers following repairs to the sills, vertical elements, and footings, the building will be made level in both north-south and east-west directions using a 6' carpenters level and making adjustments with temporary wooden shims until the bubbles in the level are centered.
- a. Once the building is level, any gaps must be filled with permanent shim stones.

D.

E. Footers

- i. The building appears to rest on four masonry piers (granite or concrete), placed at each of the corners. These piers were mostly at or below grade, or otherwise obscured at the time of inspection for preparation of this report.
- ii. We recommend that after raising the building for framing repairs, the existing piers be removed and replaced with new piers that establish a level deck plane for the building and maintain a minimum of ten inches above grade.
- iii. New concrete piers should consist of 10"-diameter sonotubes.
- iv. Depth of footing and attachment to the ground will be determined by below-grade conditions found after excavation.
- v. If soil conditions permit, the new piers should pass 48" below grade, or below typical frost for this climate zone.
- vi. If bedrock is discovered at shallow depths (current grade to 48" below), 1/2" steel rebar should be drilled into the stone at a depth of 12" to secure the pier to the bedrock, and encapsulated within the sonotube and poured concrete pier.

F. Sill Repair/ Replacement

- i. Due to close contact with grade and significant overgrowth, the sills were not completely accessible for inspection at the time of investigation for this study.
- ii. Any areas of sill exhibiting superficial decay should be consolidated with epoxy resin.
 - a. "superficial decay" is defined as
 1. Penetrating to a depth of 1" or less in existing material
 2. Not affecting structural joints.
 - b. Any superficial decay, including any insect damage meeting conditions 1 and 2 above should be consolidated with Abatron® Liquid Wood.
 1. This material should be injected with syringes until the wood is completely saturated and will no longer absorb.
 2. After the appropriate cure time as per manufacturer's specifications, any voids that effect the sound, level re-installation of trims, sheathing and siding will be packed with West System epoxy.

- iii. All sills requiring replacement should match existing work in materials, dimensions and methods of joinery.
- iv. Pending further investigation, we recommend that any sills requiring replacement should be replaced with 8" x 8" rough-sawn hemlock timber.
- v. All new sills must be treated with a borate solution such as Boracare® to deter future insect infestation. This includes working the material into all woodworking joints prior to assembly.

G. Floor Joists

- i. The condition of the joists supporting the building from below is entirely unknown. However, the floor sags noticeably toward the center and deflects underfoot, indicating possible framing problems.
- ii. Upon raising the building for sill repairs, if the joists are found to be in poor condition, sistering or replacement may be used.
 - a. Sistering (applying a helper timber to the side of an existing joist) will be employed if the joist
 - 1. Exhibits less than 1" of penetration of decay or wood loss
 - 2. Exhibits cracks but the wood is otherwise sound
 - 3. The joints connecting the joist to the sill are sound.
 - 4. The timber is sound enough to be raised to reasonable level, removing as much sag as possible, without damage to the timber or surrounding materials.
 - b. Sister timbers will consist of 2" x 8" rough-sawn hemlock lumber.
 - c. Joists will be replaced if
 - 1. Greater than a 1" depth of wood is lost or damaged due to decay or insect infestation
 - 2. Decay affects joints attaching the joist to the sills
 - 3. The timber is not sound enough to be raised to reasonable level, removing as much sag as possible, without damage to the timber or surrounding materials.
 - d. Replacement joists will match the existing material in dimension and workmanship, and will be fabricated from rough-sawn hemlock timber.

H. Vertical Framing- Posts and Studs

- i. General
 - a. The posts and studs supporting the structure exhibit significant levels of deterioration, particularly in the north wall around and below the window.
 - b. This section only addresses the bottoms of the framing elements, which are the portions of the timbers that need to be sound enough to attach adequately to the sills and support interior and exterior finishes.
 - c. Determining the extent of repair versus replacement for the framing will involve further investigation: removal of exterior trim, clapboards and sheathing. See Part 1, Sections E and F.

- d. Portions of framing elements will be cut out and replaced only if any area of damage reduces the timber profile to less than 40% of its original sectional dimensions.
 - e. No repairs will take place until the wood is allowed to air-dry to a moisture content of 15% or below.
- ii. Timber Consolidation
- a. All areas of timber exhibiting greater than 40% of sectional integrity, but otherwise exhibiting damage from insects or decay, will be impregnated with wood hardening epoxy.
 - 1. Abatron® Liquid Wood is recommended.
 - 2. Each timber will be fully saturated with Abatron® Liquid Wood until the damaged area can no longer absorb the material.
 - 3. Apply and allow to cure as per manufacturer's specifications.
 - b. Any areas of voids in consolidated material that create irregular planes on the timbers that would affect flat, even installation of sheathing or siding must be packed with epoxy fills.
 - 1. For this, we recommend West System® epoxy.
 - 2. Apply and allow to cure as per manufacturer's specifications.
 - 3. Shape to be flush, flat and parallel with surrounding original wood, using hand planes and SurForm® planes.
- iii. Timber Grafts
- a. Any areas of studs or posts exhibiting less than 40% sectional integrity will require grafts. This will require removal of severely damaged wood and replacement with new, sound material.
 - 1. Damaged material will be cut back only to a point where 40% of sectional integrity is regained.
 - 2. Any remaining damage in the cut-off area will be consolidated and re-shaped with epoxy. See Section 2, Timber Consolidation, above.
 - b. New wood will be joined to the existing material with simple English scarf joints.
 - 1. Scarf joints will be a minimum of 10" long for studs and 16" long for posts.
 - 2. The shoulders of the scarf joints will not exceed 50% of the overall thickness of any original member.
 - 3. The scarf joints will be oriented to make the best use of, and retain the greatest amount of surviving original wood.
 - c. New material will be attached to existing wood using epoxy as an adhesive.
 - 1. Abatron® Liquid Wood will function as a bonding agent. It will be applied to the surfaces of the new and old wood at the repair site and allowed to cure as per manufacturer's specifications
 - 2. West System® epoxy will form the bond itself. The adjoining surfaces of new and old material will be "battered" with this material and pressed together with clamps.

3. Before the epoxy sets, care will be taken to ensure that the grafted materials properly align with the old: straight, flat, level and plumb.
- d. Each scarf joint will be reinforced with stainless steel lag bolts.
 1. The lag bolts will be 3/8" diameter stainless steel for studs and 1/2" diameter for posts.
 2. A minimum of two lag bolts will be used per scarf joint.
 3. The lag bolts will be staggered or offset so they do not align with one another.
 4. Each lag bolt will pass through the entire graft and will be fastened with a stainless steel washer and nut.
 5. Where lag bolts must be installed on the face of a timber that will later be covered with exterior sheathing or interior finishes, the lag bolts must be countersunk so the heads are below the surface plane of the timber. This will allow subsequent materials to lie flat against the timber.
- e. New wood will consist of 100% heartwood white pine with a minimum of 8 growth rings per radial inch. No sapwood content is permitted.
- f. New material will match the dimensions of the existing material.
- g. All woodworking joints attaching replaced areas of wood to other members (such as mortises connecting the posts to the sills) will be replicated.
- h. Prior to installation all new wood, particularly end grain and woodworking joints, will be treated with a borate solution such as Boracare® to deter insect activity.

I. Exterior Sheathing Repair and Replacement

- i. Repairs to sills and other framing elements will require some removal of siding and sheathing. See Part I. E. Removals.
- ii. An element will be considered "salvageable" if it conforms with criteria described in Part 1. G. Salvageable versus Unsalvageable Elements.
- iii. Severe decay of exterior sheathing was observed on the north wall in the area surrounding the window.
- iv. Any exterior sheathing that is either missing entirely or too deteriorated to retain, must be replaced in kind.
 - a. All replacement sheathing boards must consist of rough-sawn white pine plank matching the thickness and general widths of the originals.
 - b. Circular-sawn wood is recommended so it will reflect its own time and will not be confused with original or historical materials.
 - c. All new sheathing boards must contain a minimum of 80% heartwood.
 - d. The new material will be installed with butt joints matching the character of the originals.
 - e. All new sheathing boards will be fastened to framing with stainless steel trim screws.

J. Exterior Trim Repair

- i. All exterior trim elements, including corner boards, ledger boards, frieze boards, door and window trims, will be retained in place if they are deemed “salvageable.” (See Part 1. G. above).
- ii. Any salvageable elements requiring repair will be retained and repaired with Dutchmen-type grafts.
 - a. Any friable wood will be cut back to clean, bright, sound wood.
 - b. Any vertical member requiring a graft will be cut with a downward-pointing bevel at 45 degrees.
 - c. All new wood will consist of 100% heartwood white pine with a minimum of 8 growth rings per radial inch.
 - d. All grafted wood will be attached to the building with hand-forged nails as per the original material.
 - e. All graft joints between new and old wood will be reinforced with epoxy.
 1. FlexTech HV® by Advanced Repair Technologies is recommended.
 2. Follow manufacturer’s recommendations for all application procedures.
 3. After the appropriate cure time, any epoxy squeeze-out will be chiseled and sanded flush with the wood surfaces.

K. Exterior Trim Replacement

- i. Any trim elements that are either missing entirely or are present but deemed unsalvageable will be replaced in kind. This includes:
 - a. Jambs and jamb liners in the south door frame
 - b. Window trims on the north elevation
 - c. Corner boards
- ii. All replacement elements will be made from 100% heartwood white pine with a minimum of 8 growth rings per radial inch.
- iii. All replacement moldings will be based on existing dimensions and profiles.
 1. All nails will consist of 2 ½” stainless steel, ring-shank trim nails.

L. Clapboard Replacement

- i. The north elevation at a minimum requires significant clapboard replacement. Lower courses of existing clapboards may require replacement as part of sill and joist repair. All existing clapboards that are in sound condition should be retained.
 - a. “Sound condition” is defined as free of decay and with no cracks that are:
 1. Longer than 6 inches if they pass completely through the clapboard
 2. Or are longer than 18 inches if they do not pass completely through the clapboard.
- ii. All replacement clapboards will be fabricated from radially-sawn 100% heartwood white pine with no less than 8 growth rings per radial inch. These are available from Stephen Jefferys in Lee, New Hampshire (603-664-9002).

- iii. All methods of joinery seen on the surrounding existing siding will be replicated.
- iv. All new clapboards will be fastened to the sheathing with hand-headed siding nails matching the appearance of original examples on the building.
 - 1. All nails will consist of 2" stainless steel ring-shank siding nails.
- v. No back-priming, pre-priming, or any pre-treatment is recommended for the clapboards prior to installation.

M. Window Sash Restoration

- i. The building retains its original nineteenth-century six-over-six sashes. All require minor restoration. This includes paint removal, glazing repairs and repainting.
 - a. The sashes should be carefully removed from their frames for treatment.
 - 1. See Part 1. G. above.
 - b. The interior faces of the sashes will be left untreated.
 - 1. During repair, the inside faces of the sashes will be adequately protected from scratches, dents and dings.
 - c. Because there are no broken panes and most of the glass is very old, possibly original, we do not recommend removing any panes. All should be left in place.
 - d. Only loose, friable glazing and paint should be removed. Areas of paint and glazing that are sound and do not break free easily will be left intact.
 - 1. This should only be done with flat-bladed paint scraper with a fresh, sharp edge.
 - 2. Only enough hand force will be used to remove paint and glazing that will freely break loose without gouging the wood or stressing the glass.
 - e. Any whiskers of raised grain or wood fibers created from paint removal will be removed by hand with 150-grit sandpaper only.
 - f. The sashes will be primed using only Fine Paints of Europe® Alkyd Primer.
 - g. After a minimum cure time of 24 hours, missing glazing will be patched in using Sarco Linseed Oil Glazing Putty.
<http://smithrestorationsash.com/glazingputty.html>
 - h. After a minimum of 21 days of cure time for the glazing, the sashes should be completely coated with a second coat of primer (see above). Putty continues to shrink and will cause paint to crack if applied sooner.
 - 1. Primer should extend 1/8" over the putty lines and onto the glass to create a weather seal between the glazing and glass.

N. Exterior Paint

- i. Preparation
 - a. Following repairs, all exterior wooden elements should be properly prepared and properly painted.

- b. To reduce potential damage to the surface of the wood during preparation, and to ensure proper adhesion of new paint, no work shall commence until the moisture content of all exterior wood is at or below 15%.
 - c. Scraping and Sanding
 - 1. All paint removal will be done by hand with sharp, flat-bladed scrapers such as a Five-in-One tool. No pointed or curved blades are permitted.
 - 2. No power equipment is permitted for paint removal. The following are forbidden:
 - i. Pressure washing
 - ii. Rotary grinders
 - iii. Rotary sanders
 - iv. Sand blasting
 - d. Only paint that loosens easily with moderate hand pressure will be removed. Excessive force will result in damage to the wood and is forbidden.
 - e. Following scraping, surfaces can be made even and smooth with sandpaper.
 - 1. Only hand sanding is permitted.
 - 2. Sandpaper grits 80, 100 and 150 are permitted.
 - f. All existing nail heads will be gently sanded to remove surface corrosion prior to new paint.
 - g. Each nail head will be spot-treated with a generous application of Penetrol® using an artists' brush to seal it prior to repainting. Penetrol will be allowed to dry completely before paint application.
- ii. Paint Type
 - a. Fine Paints of Europe (www.finepaintsofeurope.com) is recommended. This paint most closely replicates the appearance of historic paints in a modern setting, and outperforms all domestic brands.
 - b. As a less expensive alternate, use Sherwin Williams A-100 Alkyd Primer.
 - iii. Paint Application
 - a. Primer: Fine Paints of Europe Alkyd Primer or Sherwin Williams A-100 Alkyd Primer
 - 1. Apply in one coat following manufacturer's specifications.
 - b. Finish Coats: Fine Paints of Europe "Hollandlac" exterior alkyd enamel.
 - 1. Siding: Hollandlac "Satin" sheen
 - 2. Trim: Hollandlac "Brilliant" sheen
 - c. As a less expensive alternative: Sherwin Williams Super Paint exterior acrylic enamel.
 - 1. Siding: "Satin" finish
 - 2. Trims: "Gloss" finish
 - d. Finish only by hand with brushes.

1. Spraying devices or rollers are permitted only for expedient application- any paint applied in this manner must be immediately back-brushed by hand.
 2. Create long, straight, parallel brush strokes following the long direction of each element.
- e. Application, including environmental conditions and recommended cure times must follow manufacturer's specifications.