THE NEW HOPE EXPERIMENT: AN INVESTIGATION AND CONSERVATION PLAN FOR THE ANTONIN AND NOÉMI RAYMOND FARM

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1.0 Introduction

This thesis intends to contribute to the understanding of the main farmhouse of the Raymond Farm Center for Living Arts and Design, located in New Hope, Pennsylvania through investigation of its historic context, materiality, change over time, and building condition assessment. Through this background information, this thesis will also generate a list of prioritized treatment recommendations regarding the material conservation of the structure in line with the Center's mission and abiding by accepted conservation values.

The initial idea for this thesis was inspired by a conversation with an acquaintance that relayed their involvement with the relatively new non-profit arts organization the Raymond Center for Living Arts and Design. This spurred initial research into the Raymonds careers and works, which included not only professional architectural practice, but also furniture design, textiles and lighting, and many others. Their long architectural practice was interwoven with projects in both Japan and the United States, but it became quite clear that though the Raymonds had established themselves as revolutionary early modernists and were recognized as founders of the movement in Japan, their importance was until recently understood by only a few in the United States.

This research provided an interesting connection to the author's own experience, as the Raymonds were teachers to modernist architect Yoshimura Junzô, who had designed Shofuso, a traditional style Japanese house museum that was built for the Museum of Modern art in 1953, and later moved to Philadelphia, in which the author had previously spent three years of employment and enjoyment. This tie proved to be a special draw for the author, who had interest in discovering the extent of connections between the principles of architecture displayed at the Raymond Farm Center and those learned through previous experience and education with various architecturally Japanese influenced sites. The Center's main building, a 1740s fieldstone Quaker farmhouse which had been retrofitted with Japanese and Modernist styles during the Raymond's occupation also proved to be an enticing challenge to decode the building's chronology through investigation of various architectural elements. These complimenting styles of vernacular Pennsylvanian and Japanese domestic architecture are both of great interest to the author, who has resided in both Pennsylvania and briefly in Japan.

The author's first visit to the site occurred in October of 2017, in attendance of one of the larger programs being conducted at the Center, entitled After Wright: Pathfinders of Regionalism & Sustainability - Rudolf Schindler, Richard Neutra, Antonin & Noémi Raymond. Coincidentally, this initial study occurred just before the Raymond Farm Center was used as one of three sites under investigation during the University of Pennsylvania's Historic Preservation course *Seminar in Architectural Conservation: Masonry and Wood,* in which the author participated, and along with a team of three other students, began assessing the structures material components.[1] It is hoped that this thesis, founded from the initial seminar report, will inform the nascent non-profit's conservation and maintenance plan for this building, and that future studies will be made of the complex's landscape and other structures.

Archival research was conducted at the Architectural Archives of the University of Pennsylvania, the Solebury Township Historical Society, and in unpublished documents kept by the Raymond family.

[1] The team of students that conducted preliminary work at the Raymond Farm during the course of the Fall 2017 Wood Seminar included Alberto Calderón and Anthony Hita, who conducted the exterior wood condition investigation, John Giganti who determined method of manufacture of basement joists, and Sara Gdula (the author) who determined an initial chronology for the interior features and recorded UV light levels throughout the house. The author expanded and updated their work during the course of this thesis. This work was supervised by Andrew Fearon, the professor of the class and Chief Conservator of Materials Conservation.

1.1 Project Overview

The goal of this thesis is to build an advanced understanding of the material fabric at the Raymond farm house by conducting physical investigation to create a building chronology, condition assessment, and prioritized treatment recommendations, with the intent of informing a future site-wide conservation plan. This work has been conducted in line with the goals of the site set by the non-profit organization, in which they hope to foster an intellectual and physical environment that promotes creativity in the spirit of Antonin and Noémi Raymond. This thesis provides the necessary investigation of physical site conditions and provides recommendations that might be implemented to create a more livable space while also offering protection and longevity of both the material fabric and inherent values of the site. Physical investigation performed in this work includes analyzation of certain elements of the building such as doors, windows, woodwork, fasteners, and hardware. These components are able to inform likely dates of origin based on clues in their physical form that relate to manufacturing method or construction technology. Other methods of investigation include selective gravimetric mortar analysis, prolonged environmental monitoring, and infrared thermography. Notation of the conditions found in the building fabric forms the basis of the diagnostic process, and prioritized recommendations for treatment are included in order to conserve the building in accordance with accepted conservation values and the Center's overall mission.

1.2 Building Description

Located in Solebury Township just south of Pidcock Creek Road and directly west of the intersection with Covered Bridge Road, the Raymond farmhouse lies at the top of a small rise that looks south over a landscape of trees, rolling fields, ponds, Pidcock creek, and the Van Sandt covered bridge which spans it (Figure 1). The long sides of the rectangular footprint face north and south almost directly, and a semicircular driveway leads northward toward Pidcock Creek Road. Other buildings in the complex include a large bank barn, various agricultural buildings, and a separate house and studio. The entire site encompasses about 120 acres of land.

Figure 1. Site view of the Raymond Farm Center in relation to nearby infrastructure. The Farm House is outlined in red. Source: Google Maps, Accessed April 23, 2018.

The envelope consists of irregularly coursed local fieldstone consisting of various types of stones including granite, slate, limestone, among others in the main body of the building, and a wood framed addition to the east sided with cedar shiplap extending into a large covered porch (Figures 2 and 3). The stone component on the west side of the structure rises three stories above grade, and the wood addition to the east reaches two stories, and both portions sit overtop a stone and CMU foundational basement respectively. Two brick chimneys extend above the interior side of the stone gable. A large portion of the southern façade consists of cedar siding and large panels of sliding glass windows to allow large amounts of light and air into the structure and to survey the landscape described above. The north façade is five bays long on all three floors, asymmetrically broken up by the main entrance. There are a total of eight entry points, including three doors on the north façade, of which the main entrance is encompassed by an enclosed genkan entranceway, an entrance on the east via the covered porch, a series of sliding glass doors and a single panel door that open to the south, a door leading from the house towards the barn to the west, and the basement storm doors.

Figure 2. North Elevation of the Raymond farmhouse. Photo credit: Anthony Hita, November 11, 2017.

Figure 3. South elevation of the Raymond farmhouse viewed from the lower slope. Photo credit: Anthony Hita, November 11, 2017.

1.2.1 Basement

The basement can be accessed be either a small stair in the eastern addition as well as exterior storm doors against the western elevation. The basement has a mostly open floor plan with the exception of a truncated fieldstone wall offset just east of the center of the rectangular footprint, with central columns and a large beam supporting exposed joists. These joists display different saw and axe marks, and a few still retain their bark.[2] Fieldstone arches supporting the fireplaces on the first floor are centrally located on the east and west interior elevations, however the eastern arch has had areas of brick and CMU replacement. Several appliances are on the eastern end of the basement, including a hot water heater and furnace. Pipes penetrate the northern elevation to reach exterior sub-grade fuel tanks. Several radiators are located along the southern elevation, elevated off the basement floor but remaining below the floorboards of the first floor. Openings through the first-floor boards allow the heat to rise to the first floor.

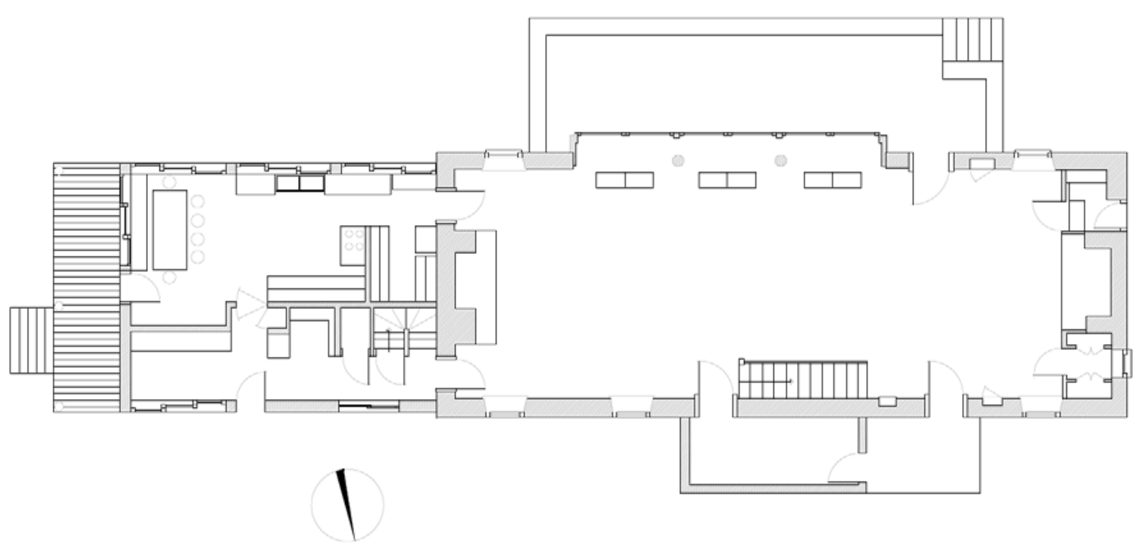

Figure 4. First floor plan. Source: Author.

[2] These variances were recorded and mapped by John Giganti during the Fall 2017 Wood Seminar and are viewable in appendix F.

1.2.2 First Floor (Figure 4)

Through the genkan and main entrance lies a large room with an open floor plan, extending between fireplaces on the eastern and western ends of the stone envelope, with a band of sliding glass doors straight ahead and the foot of the stairway to the second floor is immediately to the right of the entrance. A light well opening to the second floor cuts up through a portion of the ceiling, which is comprised of cedar boards to the east of the well and revealed wood joists to the west. The fieldstone walls of this room are either plastered in white or are of white painted rigid foam insulation with a thin cement face attached to the fieldstone substrate. Two small niche cupboards embedded in the stone envelope mirror each other on the western end of the north and south elevations. On the interior western elevation, wooden partitions with matching batten doors flank the fireplace, the northern one leading to a storage area with cupboards and a small window, while the southern door leads to a small mud room with a door leading out towards the barn. The western fireplace in the main room has a protruding wood mantel and stone hearth, the main difference in the eastern fireplace being that the wood mantle Is recessed into the stone masonry in the form of a lintel. Large, wide planks comprise the floor, and wooden grilles cut down to the basement along the southern sliding glass doors to allow for hot air from sunken radiators to rise without impeding the view, whereas four metal radiators line the north and south walls otherwise. Two doors flanking the eastern fireplace lead to the addition, the first floor encompassing a kitchen and pantry area comprised entirely of built-in wood cupboards, a small bathroom, and stairs to both the basement and second floor. In a similar situation to the floor vents of the main room, the built-in benches in the southeastern corner of the room that serve as a dining area have openings to the basement, where radiant heat is produced to filter through and warm the seats.

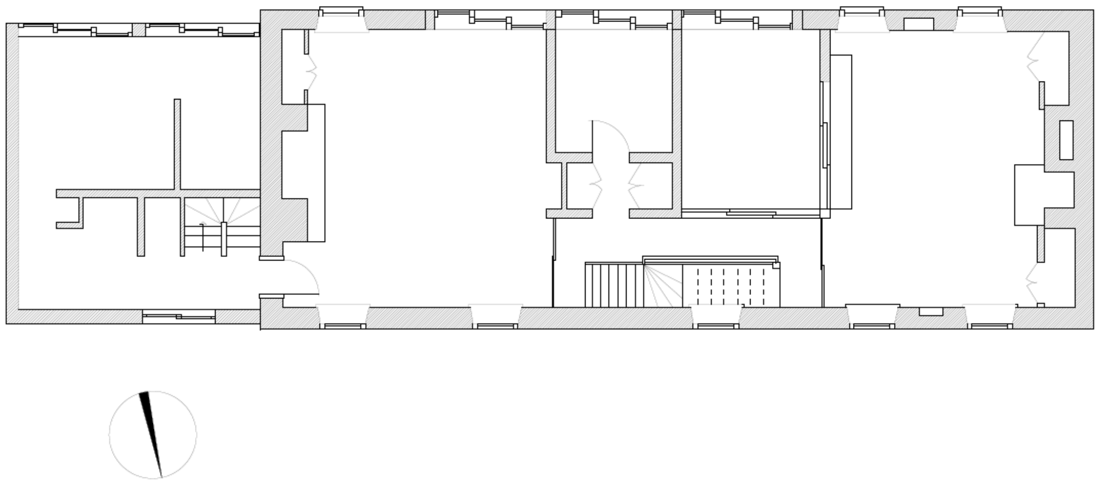

Figure 5. Second Floor Plan. Source: Author.

1.2.3 Second Floor (Figure 5)

The second floor, as accessed from the stairwell in the main first floor room, opens up to a small mezzanine hallway area which looks down and through the light well to the floor below, protected by a waist-high wooden partition. This partition has inbuilt shoji tracks, the small sliding papered panels able to close the viewing area and east bedroom off from view through the light well. The flooring of this level with the exception of the east bedroom is comprised of more modern, thin floorboards. The east bedroom exhibits the same type of flooring and wall style as the first floor, with wide boards, plaster covered stone wall on the east interior elevation and finished rigid insulation covering the north and south interior elevations. Two large closets are built into the stone of the eastern elevation, with a small fireplace between them which is closed off by a removable wood cover which has been papered with Japanese washi fiber paper. On the eastern side of the light well, a small storage area with inbuilt wood cupboards acts as a connective space between the mezzanine hallway and a small bathroom on the south side of the house. As such, large sliding glass windows provide access to natural light into a bathroom with toilet, sink, and tub. Here, the cedar board walls are treated with a protective clear coating from the floor to approximately 5 feet high to resist water splashing from the appliances. A closed wooden partition utilizing a modern door closes the eastern room off from the rest of the stone envelope, as this is currently part of the private residence in the building. This room has a closet similar to the ones in the western bedroom on this floor on the southern portion of the eastern elevation, fireplace near the center of the wall and a door to access the eastern addition to on the north side of the eastern elevation. Through this door to the addition lies a hallway with an inbuilt closet, bookcase, and stairwell access to the addition's first floor. At the end of this short hallway lies a small bathroom and two small bedrooms with more built-in closets and storage areas. A small staircase is located in the mezzanine hallway against the north elevation that reaches the third floor.

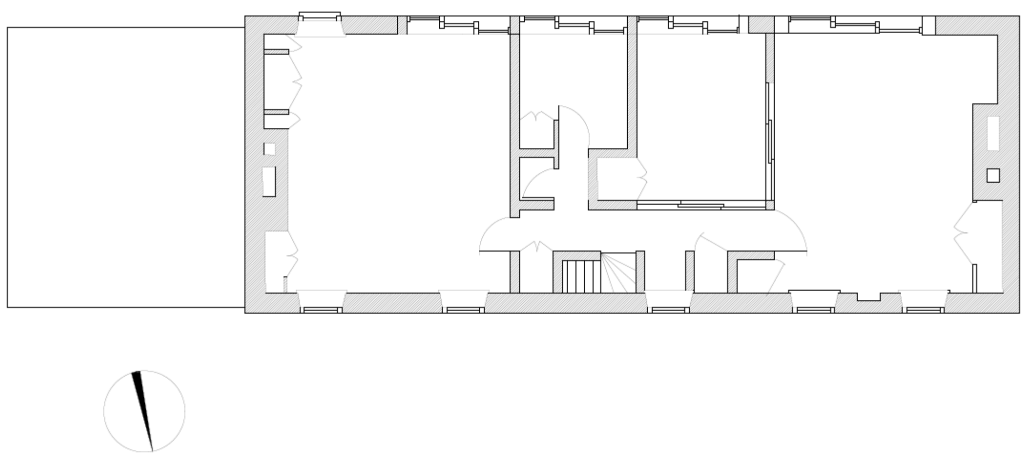

Figure 6. Third floor plan. Source: Author.

1.2.4 Third floor (Figure 6)

The twisting staircase that reaches the third floor opens up onto another central hallway just as the second floor, however the light well does not reach this floor. Instead, a small room that can be closed off by shoji doors on metal tracks. This room contains a row of sliding glass windows on the south elevation, and the ghost of a kitchenette unit are on the eastern wall, with capped plumbing extending from the wall. The westernmost bedroom also has the same sliding glass windows on the south elevation, with two sash windows on the north elevation. The walls in this room are plaster covered stone. The western elevation has a recessed area to the south, then a closet to the north. A small closet is set into the north side of the east wall in this room. Similar to the second floor, a bathroom is located just to the east of the kitchenette bedroom, however the toilet is in its own small room just off the central hallway with the sink and tub located just past this to the south, also utilizing sliding glass windows. The easternmost room on the third floor utilizes the same sliding glass windows on the south elevation and sash windows on the north. Two wooden closets are built into the eastern elevation of this room. The eastern addition does not have a third floor; therefore, the east room of the stone envelope does not have an access door.

2. Historical Context

While this work does not intend to add to the scholarship on the Raymond's lifetimes of achievements, it is important to note the background of circumstances that eventually led them to connect with their New Hope home and how the came to blend regional vernacular architecture with Japanese architecture that conveyed the principles of Modernism. Extensive research into the Raymond's lives has been undertaken by several scholars, particularly the book entitled *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond* which was compiled by several authors and edited by Kurt G. F. Helfrich and William Whitaker to create a comprehensive look at their combined careers and how they shaped and were shaped by the Modernism movement with their particular affinity for Japan. What follows here is a brief summary of the Raymond's works as researched by those authors in order to create an understanding of their processes at the New Hope farm.

2.1 History of Raymonds and their work before 1939

Noémi Pernessin was born in Cannes, France in 1889 to Swiss-French parents. At the age of 12, she moved to New York with her mother and American stepfather, and she later attended Columbia University where she majored in Fine Art, Philosophy, and "violent exercise" (calisthenics and basketball). Here at Columbia, she met and studied under Arthur Wesley Dow, who was very influenced by his previous studies in Japan. He promoted an idea of "an intelligent way of seeing" in which viewers can appreciate very different art works from Japanese ink paintings to Gothic statues, as well as the concept of "Pure Design" which recognized the universal art forms underlying works from all cultures.[3] She then travelled back to France, where she attended the École de la Grande Chaumière to study art for a year, but the threat of World War I caused her early return to America.

It was on this ship back to America in 1914 where Noémi met Antonin Raymond, a Czech-born designer and artist who had lived and worked in America for several years under Cass Gilbert, and in this capacity had worked on a number of architectural projects before attempting a career as a painter.[4] As the War also curtailed a European painting trip for Antonin, he also was in the process of returning to America when this meeting aboard the ship was sparked by a mutual admiration of a piece of green glazed Italian Folk pottery.[5] As the pair

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[3] Kurt G. F. Helfrich, with Mari Sakamoto Nakahara, "Introduction: Rediscovering Antonin and Noémi Raymond", in *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond*, ed. Kurt G. F. Helfrich and William Whitaker (New York: Princeton Architectural Press, 2006), 16.
[4] Ken Tadashi Oshima, "Characters of Concrete", in *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond*, ed. Kurt G. F. Helfrich and William Whitaker (New York: Princeton Architectural Press, 2006), 66.
[5] Kurt G. F. Helfrich, with Mari Sakamoto Nakahara, "Introduction: Rediscovering Antonin and Noémi Raymond", 15.

discussed design and the arts, their friendship and romance grew, and they were married by the end of the same year.[6]

During their early married life, Noémi supported Antonin as he attempted to continue painting in her work as an illustrator and cartoonist, however they both soon began to work as unpaid interns under Frank Lloyd Wright at his studio at Taliesin in 1916. Antonin enlisted in the Army and served from 1917-1919. Frank Lloyd Wright then recruited the couple to assist him with his work on the Imperial Hotel in Tokyo in early 1920, however the couple's involvement lasted only for about a year before a parting of ways after a disagreement between Antonin and Wright. In his autobiography, Antonin writes of his work on the project, "It was not long before I began to feel that the design had nothing in common with Japan, its climate, its traditions, its people and its culture."[7] Rather than return to America, the couple decided to remain in Japan, and Antonin and a Cornell trained architect Leon Whittaker Slack began their own practice called The American Architectural and Engineering Company in Tokyo. Their company oversaw thirty-nine commissions in this first year, including a new campus for the Tokyo Women's Christian College, St. Luke's International Hospital, and a house for the then-Mayor of Tokyo. Noemi also publishes her first essay on design entitled "Tokyo's Hermit Crabs: Out Artistic Immorality and Decorative Barbarity".[8]

It was during this tenure in Japan that both Antonin and Noémi began to develop their style of design that would be cultivated and polished through the remainder of their lives. Japan, basically untouched by the Western culture until the recent past, provided the backdrop in

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[6] Ibid, 16.

[7] Antonin Raymond, *Antonin Raymond: An Autobiography*, (Rutland & Tokyo: Charles E. Tuttle Company, Inc., 1973), 71-76.

[8] William Whitaker, "Chronology of the Raymond's Lives and Careers", in in *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond*, ed. Kurt G. F. Helfrich and William Whitaker (New York: Princeton Architectural Press, 2006), 266.

which their ideals of simplicity and truth in workmanship and materials could be found naturally in many crafts, including architecture. Here Antonin brought Western style modern techniques and aesthetics to synthesize with the simplicity of form and natural materials found in the Japanese culture and architecture. Examples of this synthesis were found in many of their inter-war projects, particularly the Italian Embassy Villa and their own house and studio in Karuizawa. They developed a particular affinity for exposed concrete houses, which were earthquake-resistant, yet comfortable and livable thanks to the Noémi's interior design. These houses provided the clients with both Western and Japanese styled rooms, fitting their dual roles of Western development while retaining cultural traditions. Many of these houses utilized modern ideals described in the following section via large swaths of windows oriented towards the south to take advantage of natural sunlight and air. In the course of their work, they developed relationships with many types of craftspeople in their inter-war years, including carpenters, potters, and designers of all kinds.

During this time in inter-war Japan, many things developed in both their personal lives and careers. As preeminent modernists, they forged relationships with several people in positions of power, including the Akaboshi family and the U.S. Ambassador to Japan. Eventually the name of the practice was changed to Antonin Raymond, Architect, and Antonin became a member of the American Institute of Architects. Their son, Jean François was born in 1926, and was nicknamed Claude. The couple begins to travel together and separately to several other areas of the world, including China, Canada, and many European countries. Antonin is even appointed honorary consul of the Czech Republic in Japan. Several works regarding their careers are published, such as *Antonin Reymondo no sakuhinshû* (The Works of Antonin Raymond), *Antonin Raymond: His Work in Japan 1920-1935*, and appeared in several other architectural journals.[9] Probably most important of these publications is Antonin's second book entitled *Architectural Details*, which had little text but rather graphical representations of the details of his work. While it seems that Noémi is underrepresented here, it should be known that she provided a key driving force behind the scenes in the practice, urging Antonin away from Wright's style and creating his own, all the while continuing her work with interiors, textiles, woodblock prints, and design. Many of her works were incorporated into the couple's general output, however much of it is credited to Antonin in order to build their public presence.

Though the couple developed by working together, they also trained and mentored many other young talents in their Japanese office, including Yoshimura Junzô, Maekawa Kunio, and George Nakashima, among many other office staff. These relationships went beyond employer/employee and developed oftentimes into deep friendships. George Nakashima was put in charge of a large dormitory project for an Ashram in Pondicherry, India when the couple decided to leave their office in the care of their Japanese staff and return to America to escape the looming war in Japan. The couple originally established an office in New York City, and began to spread their influence there. An exhibition of the couple's combined works opened in the Rockefeller Center in February 1939 which displayed Antonin's renderings and photographs, Noémi's textiles and rugs, as well as items imported from Japan including *fusuma* and *shoji*. [10]

Though this exhibition was met with success and favorable publicity, and the Raymonds considered themselves somewhat well-established on the American architectural scene, they still encountered some difficulties, particularly financially. When they left their Tokyo office,

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[9] Ibid, 269.
[10] Kurt G. F. Helfrich, "Antonin Raymond in America", in *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond*, ed. Kurt G. F. Helfrich and William Whitaker (New York: Princeton Architectural Press, 2006), 47.

they had the intention of returning, however they instead decided to return to America directly after their trip to Pondicherry, India. This meant that most of their money was tied up in Japan, and the Japanese government placed restrictions on foreign investments removing their capital from the country's banking system. Correspondence between the couple and their Japan office included many requests for their staff to apply to be able to remove this money from their account and send it to America, however they met with minimal success. As a result, the couple decided to invest what money they had available to them in a property in New Hope, Pennsylvania.

2.2 Influences and Ideals

After Raymond's return from Japan to the United States in 1938, he began experimenting with the concept of regionalism, with the ideas of Lewis Mumford bearing the greatest impact on his American domestic architecture for the next decade. These ideas of regional decentralization were advocated by Mumford as early as the 1920s, however it was his 1938 book *The Culture of Cities*, coupled with the residual effects of both industrialization and the Great Depression that particularly fueled the Raymond's outlook towards modern architecture and design at this time. In his book, Mumford explains,

> "At a period when the uniformities of the machine civilization were being overstressed, regionalism served to emphasize compensatory organic elements: above all those differences that arise out of geographic, historic, and cultural peculiarities. In its recognition of the region as a basic configuration in human life; in its acceptance of natural diversities as well as natural associations and uniformities; in its recognition of the region as a permanent sphere of cultural influences and as the center of economic activities, as well as an implicit geographic fact—here lies the vital common element in the regionalist movement. So, far from being archaic and reactionary, regionalism belongs to the future."[11]

[11] Lewis Mumford, *The Culture of Cities* (1938; New York: Harcourt Brace & World Inc., 1966) 305.

Antonin supported this sentiment, and in a 1938 interview states, "needs and materials change with climate, with the shape and nature of the land, with the occupation and the lives for which buildings are built."[12] He further promoted embracing regional differentiation and at the same time condemned the work of some of his contemporaries by saying, "What we call modern is just another style. It is rather cold and barren. No wonder people don't like it. The same modern appears in Oregon as in Pennsylvania. If it were well adapted it would not be the same. In Japan we use concrete against earthquakes; in Pennsylvania stone is probably the most economical, and in New York state the best material might be wood."[13] This economy of materials is likely rooted in the Raymond's experience living through the Great Depression, and this thriftful mindset promoted the use of local materials that would provide the basis for a structure that would seem to come from the earth itself, rather than impose itself upon it.

In the work of the subsequent decade of architectural practice in the United States, Antonin Raymond distinguished himself by embracing this regionalism while advocating underlying universal principles, which allowed him to become one of the first architects in the world to blend modern architecture with local culture. The Raymond's had seen many of these universal principles that were intrinsic in Japanese architecture and were being applied to modernism, including "appreciation of air, light and sunshine; an appreciation for space itself; an appreciation of spiritual quality in materials; and appreciation of calm and serenity."[14] These qualities were visible in the post and lintel construction of traditional Japan. Due to a climate of

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[12] Ruth Green Harris, "A Functional Architect, Human Factor is Not Neglected in Work by Antonin Raymond, a Modernist," *New York Times*, 18 December 1938 (IX) 11.
[13] James W. Holden, "Inside Design Comes First, Antonin Raymond Has Ideas on Modernism," *New York Sun*, 11 March 1939.
[14] Antonin Raymond, "The Common Ground of Traditional Japanese and Modern Architecture", in *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond*, ed. Kurt G. F. Helfrich and William Whitaker (New York: Princeton Architectural Press, 2006), 298.

mild winters and hot summers, structures were designed so that the walls could be opened to nature to allow sunlight and air to infiltrate easily. Interior walls moved to adapt the space as necessary, and limited possessions were stored away when not in use, giving rooms a multi-purpose nature. Contrastingly, European architecture had been based on the colder, harsher climate, therefore the need for sturdy, enclosed walls had developed over the course of centuries. The modern movement sought to impart the principles mentioned above to architecture, and the Raymond's successfully were able to apply them to regional styles through the use of Japanese design and craftsmanship.

This idea of craftsmanship, or that of the master carpenter, greatly intrigued Antonin, and helped to develop his own professional style when dealing with clients and laying out design. He detailed the concept of master carpenter, saying,

> "When the client called in a carpenter he gave the carpenter a list of his needs and requirements and also indicated the grade of work for which he thought he could afford to pay. The carpenter then went ahead and made the design and the estimates and talked over all the details that could not be shown on the drawings. As the client had an education in proportion to his wealth and station in life and as he knew what was befitting to him....The solution was clear from the beginning because it dealt directly with life. There was no empty speculation or abstract speculation involved in their work. They knew what kind of materials had to be used to perform the job required of them; they knew what type of construction was advisable and necessary; what particular and fit materials were obtainable in that particular locality, and what kind of construction that particular material was fit for; they knew the climate and its effects on the materials; they knew the skill and limitation imposed by skill; they knew the aesthetic meaning of the different materials besides their structural qualities; they even knew the occult (psychological) meaning of color, of texture, of materials."[15]

In this, Antonin advocated creative use of space while acknowledging the restrictions of the client's finances, the obtainability and performance of materials, and the natural surroundings

[15] Antonin Raymond, "Eighteen Years Living in Japan" Portions of it were printed in *Architectural Forum* 70, 1939, 129-31.

of the build-site within the context of the intended use for the structure. The Raymond's worked closely with master carpenters during their nearly two-decade practice in Japan and appreciated the apprentice system of learning by doing, with knowledge of good craftsmanship passed down between generations.

In crafting items comprised of materials that are natural and largely locally available, the Raymond's were of the thought that humans forge a relationship with them, recognizing the process of creation from their origins to the finished product. Antonin stated, "If we feel sentimental when we face an old colonial door it is because that wood and ourselves have a certain relationship which is human and natural" and he continued by rejecting artificial materials such as plastic by saying, "we shall probably never get very close to it because after all its origin is somewhat confused over there in a factory filled with the roar of machines."[16] With this point of view, the Raymond's embrace the universal principles that are transmitted easily through elements of Japanese architecture. Antonin continues, "we lean today to a return to natural materials which are not remote and strange. We see the beauty in natural wood, in well cast concrete filled with sand and pebbles, in stone, in well worked metals. We again feel their quality, their meaning in the universe."[17] The Raymond's appreciation for the use of natural materials by craftsmen employing generational knowledge of craftsmanship, coupled with the acknowledgement of financial limitations set by the client and of the functional use of the structure set the tone of their influence on American domestic architecture in the next decade, which began at their New Hope property.

[16] Antonin Raymond, "Common Ground of Traditional Japanese and Modern Architecture", 303.
[17] Ibid, 303.

It is not necessarily surprising that the Raymond's chose a Quaker farmstead to purchase and inhabit. In a 1922 book entitled Zen Buddhism and Its Relation to Art, Arthur D. Waley argues that Japanese Zen's closest western counterpart is Quakerism.[18] This connection is embodied by a quality of direct craftsmanship, quiet functionality, and appreciation for the landscape apparent in both schools of thought. It was these qualities that initially attracted the Raymond's to New Hope,

> "What drew me to Pennsylvania was the charm of the reposeful, well settled country side with strong stone barns and houses that looked as though they had existed for hundreds of years and as though they would last forever. There was an atmosphere of peace and serenity that worked like a balm in this overwrought world where all the great realities seem forgotten. In addition to this, you who chance to inhabit one of the old houses have surely felt the charm which the proportions and simplicity of details and materials cast upon you."[19]

It is important to recognize that though the Raymond's fitted the house with Japanese elements that portrayed the universal principles of modernism, they also embraced the Quaker functionality of the structures. The house was used to lodge the family, workers and apprentices, and the barn was utilized to shelter the livestock and to perform daily farming tasks. In this, they preserved the historic nature and use of the site while synthesizing it with their own modern aesthetic of living. Antonin conveys his appreciation for the site's original use stating, "Here due to the strong Quaker element for whom rugged simplicity was the basis from which to approach all the problems of life, architecture and all the tools and utensils employed remained strictly functional. And by that, I mean that houses were first of all shelters, fireplaces gave out heat and cooked properly, chairs were good to sit on."[20] This functional heritage of

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[18] Arthur D. Waley, *Zen Buddhism and Its Relation to Art* (London: Luzac and Co., 1922) 25.
[19] Antonin Raymond, *The Common Ground of Pennsylvania Colonial and Modern Architecture*, (1940) Unpublished manuscript located in the Architectural Archives of the University of Pennsylvania.
[20] Ibid.

craftsmanship in regional architecture that met the needs of the inhabitants within the principles of modernism was the Raymond's contribution to American domestic architecture.

The farm house in New Hope was their first attempt at incorporating Japanese elements into regional vernacular architecture. Here they experimented with shoji and fusuma paper doors alongside rustic colonial doors, along with many other elements from both traditions, a synthesis that went beyond the work of his contemporaries also influenced by Japan's architecture. To Antonin, many of these architects simply copied Japanese elements to add an air of the exotic, without full appreciation for the way of life that accompanied them.[21] For the Raymond's, these Japanese elements could be applied to many American vernacular styles within the context of emerging ideas of prefabrication that would take off in postwar American domestic architecture.

2.3 Building Chronology

By American standards, the farm house being studied by this thesis has a relatively long history, beginning in the 1730s and reaching the present. As such, it must be understood that documentation of building's construction and early style are not always readily available, as building permits and the like were not yet implemented in this country. As such, other sources such as deeds, census information, and previous scholarship can help to fill in blanks left by minimal to nonexistent primary documents. The following section utilizes a combination of this archival and scholarly research to attempt to understand the building's chronology and massing morphology.

[21] Kurt Gerard Frederick Helfrich, "Building the Contemporary House: Modernity, Regionalism, and the Ideal of Japan in Antonin Raymond's Residential Designs 1921-1952" (PhD. Dissertation, University of Virginia, 1997), 250.

2.3.1 Early History

Though Scottish in descent, Thomas Ross, born in 1708, emigrated to the Wrightstown area of United States from Ireland in 1728. Originally a tailor with farming knowledge by trade, in Wrightstown he converted from Presbyterianism to the Society of Friends, also known as Quakerism, and later became a distinguished minister in the Society. He married Keziah Wilkinson, daughter of an early Wrightstown Quaker family in 1731 at the Wrightstown meeting house.[22] Though it is currently unknown exactly where the couple resided in their early married years, deed documentation shows that Ross purchased 154 acres directly from William Penn's sons in 1737, making him one of the relatively early settlers in the area. Ross constructed a fieldstone house on the southern portion of his land and supported his family by farming in conjunction with his ministerial duties.[23] In his autobiography, Antonin claims, "the main building itself was built by a clergyman, Ross, in 1728. He came out with William Penn, who gave him a grant of 500 acres."[24] While this opens room for argument in the original construction dates, it is likely that Antonin was merely somewhat misinformed. Though Ross emigrated in 1728, William Penn was already deceased at that point.

Though modern sentiment would assume that construction began after the Ross' acquisition of the land in 1737, one cannot rule out the possibility that construction had begun prior to the official purchase. In fact, 1737 was a milestone year for real estate, as the somewhat scandalous "Walking Purchase" took place at that time. This was an agreement between William Penn's sons and the Lenape people in which the Penn brothers claimed a deed supposedly

[22] John S. Bailey, "Thomas Ross Minister of the Society of Friends", in *A Collection of Papers Read Before the Bucks County Historical Society*, Vol. 1, read April 21, 1885, (Easton: The Chemical Publishing Company), 283.
[23] "Thomas Ross" File in tax parcel folder 42-36-062 located at the Solebury Township Historical Society. Accessed January 10, 2018.
[24] Antonin Raymond, *Antonin Raymond: An Autobiography*, 172.

agreed upon in 1686 that would allow them to claim the amount of land over which a man could walk in a day and a half, to begin at the confluence of the Delaware and Lehigh Rivers near current Easton, PA. Some scholars today believe that this document may have been an unsigned, unratified treaty or even possibly a forgery.[25] After some coercion, the Lenape eventually agreed, however the Penn brothers took advantage of the unquantified amount mentioned in the agreement. Penn Land Office Agent James Logan hired three of the fastest runners to complete the task by running along a prepared trail, and the runners were supervised by the Sherriff of Bucks county, Timothy Smith, who drew a perpendicular line eastward, declaring the covered distance property of the Penn family. This effectively claimed a much larger portion of land than the Lenape had initially believed to be giving up, an area roughly the size of Rhode Island spread over several modern-day counties. This forced the displacement of the majority of the Lenape people, and the Penn brothers began selling land in the area immediately. With this in mind, it is possible that the Ross family had settled the area before 1737, and simply had to officially purchase the land when it legally became the property of the Penn family.

It is the current hypothesis that this structure began as a single-cell 1-1/2 story house, which was expanded concurrently with the growth and prosperity of the Ross family. This hypothesis is supported by several factors: First, construction seams are visible on the north façade, with the ghost outline of an infilled central door and upper story window also visible on the same elevation (Figure 7). Secondly, a foundational wall in the basement lines up with one of the construction seams, and an investigation of the first-floor joists from the basement shows a change in construction technology on either side of the wall (Figure 8). The joists to the east of

[25] Stephen C. Harper, "Making History: Documenting the 1737 Walking Purchase", *Pennsylvania History: A Journal of Mid-Atlantic Studies,* Vol. 77, No. 2 (SPRING 2010), pp. 217-233.

the wall, considered the ‘original’ construction show uneven diagonal saw marks, which indicates a method of manufacture known as pit-sawing. This method was used by early settlers to shape timbers before the advent of saw mills, utilizing a process of sawing timber laid across either a pit or along two trestles in which one man stood above the log and another below the trestle or in the pit. This resulted in a diagonal mark with uneven lines, dependent upon the motion of the combined effort (Figure 9). The joists to the west of the basement foundational wall show even up-and-down marks which indicate they were sourced from a sawmill. Archivists at the Solebury Township Historical society claim that the area did not get its first saw mill until about 1743, so it is likely that the original iteration of the farm house was constructed sometime before the introduction of this sawmill on Aquetong creek circa 1743. A 1971 map of the original land grants between 1682-1784 notes an area “Mill Tract” near the confluence of the Aquetong and the Delaware, a short distance from the Ross land (Figure 10). The final piece of evidence for this expansion during the structure’s early history comes in the form of Thomas Ross’s will, which “devises to his wife Keziah beds, bedding and bed furniture, her Bible, and what pewter she may claim, also two rooms in the new end of the house which she may choose.”[26] This will was written in 1784, three years before Ross’ death on a trip to England at the age of 78.[27]

[26] “Will of Thomas Ross” File in tax parcel folder 42-36-062 located at the Solebury Township Historical Society. Accessed January 10, 2018.
[27] John S. Bailey, “Thomas Ross Minister of the Society of Friends”, 288.

Figure 7. North elevation with arrows and red lines indicating the presence of a construction seam evident in the masonry. Photo Credit: Anthony Hita, November 11, 2017, indication alterations by author.

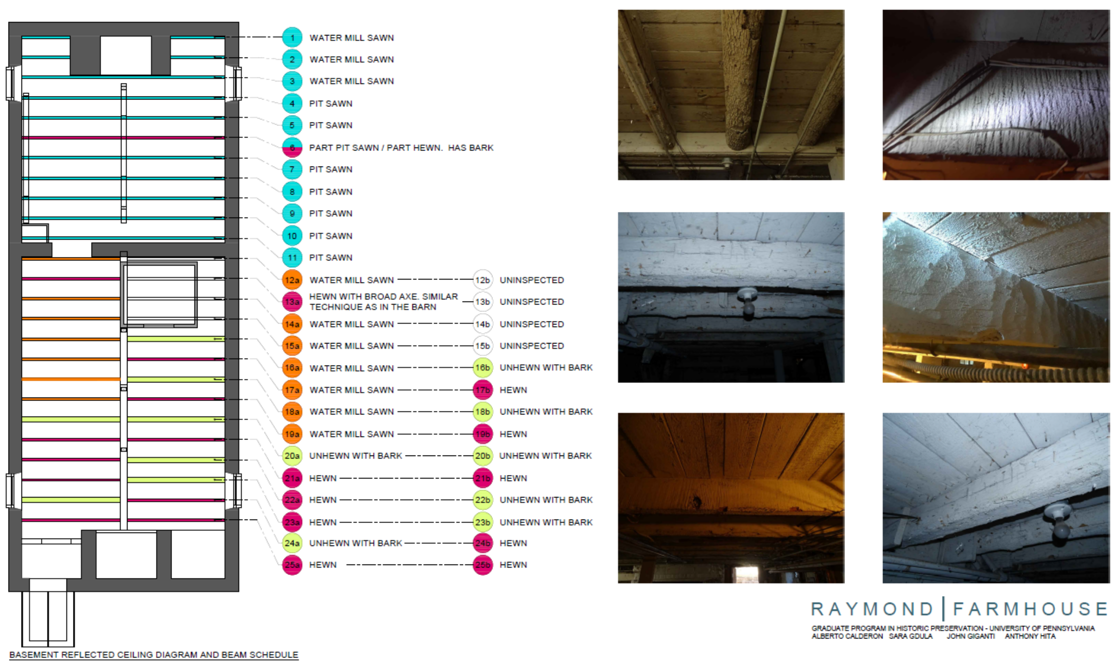

Figure 8. Joist ceiling plan indicating a change of milling technology on either side of a foundational wall. Plan oriented with the north to the left. Graphic created by John Giganti during the Fall 2017 Architectural Wood Seminar.

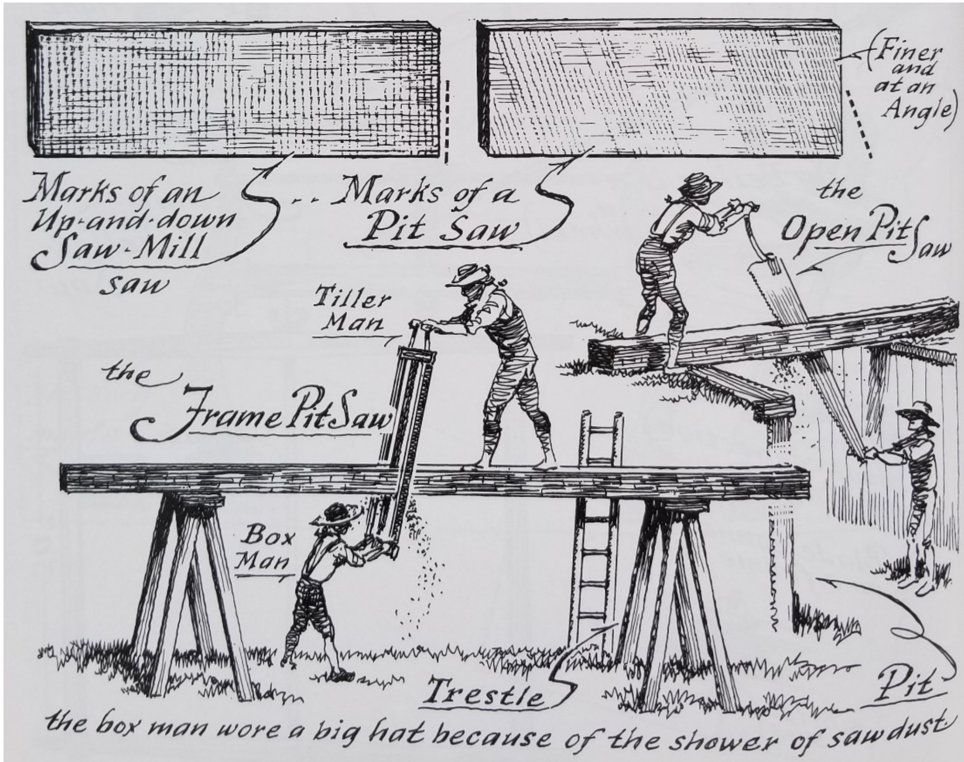

Figure 9. Example of pit sawing and the difference in marks left by a pit saw vs. an up-and-down sawmill. Source: A Museum of Early American Tools by Eric Sloane, 2002.

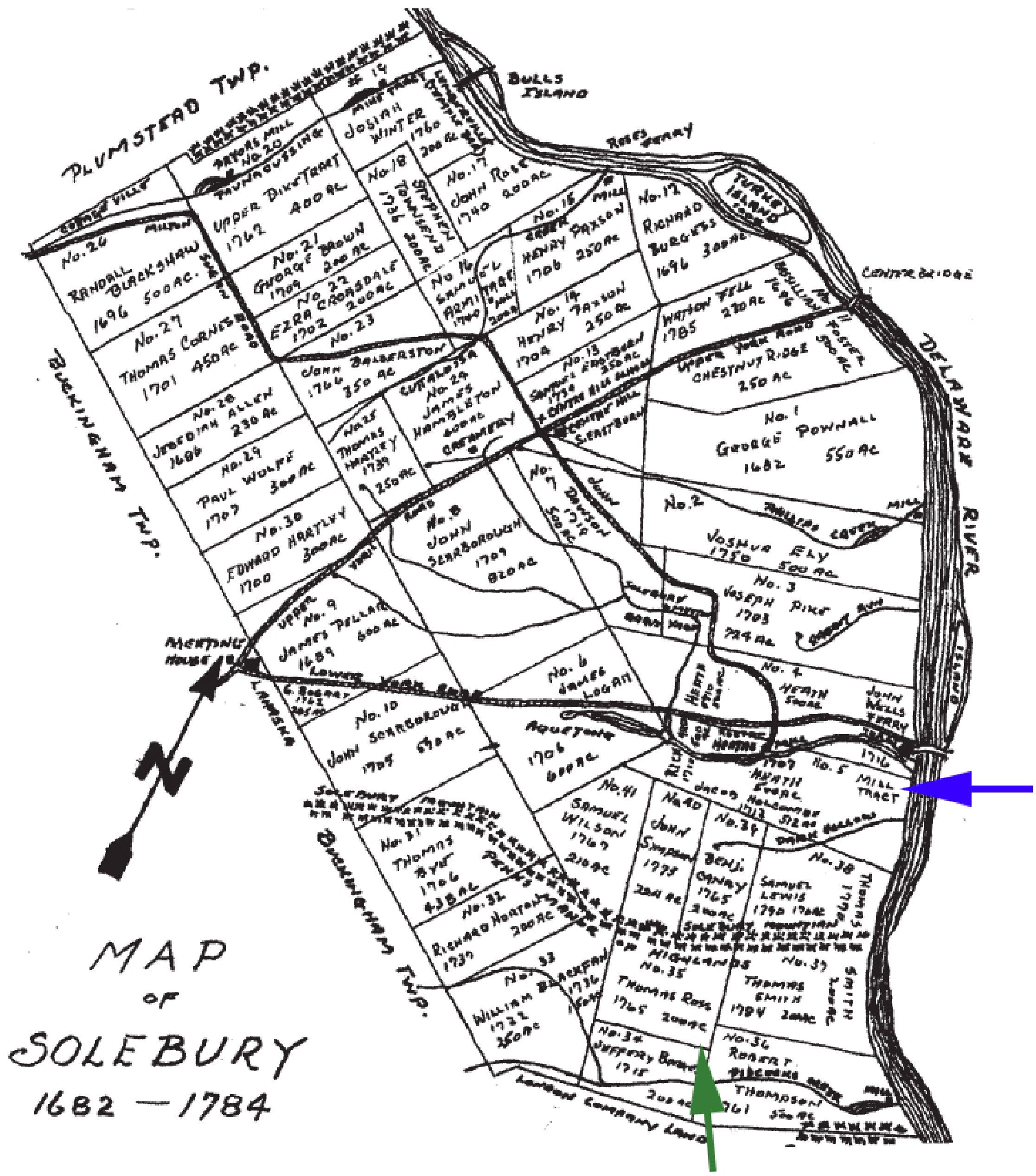

Figure 10. Map of Solebury Township, 1682-1784, showing original land grants. Drawn by John Elfman for Eastburn Reeder's 'Early Settlers of Solebury, PA', 1971. Blue arrow indicating potential location of nearby saw mill. Green arrow indicating Thomas Ross' land.

Records indicate that Keziah passed away a year after Thomas in 1787.[28] It is likely that as the Ross family expanded, the house was also extended concurrently. Thomas and Keziah had

[28] "Will of Keziah Ross" File in tax parcel folder 42-36-062 located at the Solebury Township Historical Society. Accessed January 10, 2018.

four children, one of which, John Ross took over the farming duties from his ageing parents in 1768.[29] John and his wife had seven children, so it was likely that expansion was either to accommodate Thomas's children or grandchildren. One source claims that the expansion took place in 1780, and though no primary source was cited to substantiate this claim, it fits with the scenario proposed above.[30]

While it seems that the house was utilized for farming during these early years after the passing of the Thomas and Keziah, it seems likely that the Ross family grew increasingly distant from their rural Quaker roots. After taking over the farm from his father, John Ross later moved to Philadelphia and became an esteemed physician. His elder brother, Thomas Jr. had become a well-known lawyer, and Thomas Jr.'s son would grow up to be a Pennsylvania Supreme Court Judge.[31] Though the house stayed in the Ross estate for these generations, it was eventually sold to Edward Van Sandt in 1853 as the Ross's social standing outgrew the need for the farm. The final Ross owner, Thomas (great-grandson of the original Thomas) came into the house unexpectedly through a circuitous family route and continued to reside in Doylestown until it was sold in 1853.[32] With this information, it can be inferred that when Van Sandt purchased the property, the house was likely not only severely outdated, but also affected by deferred maintenance and would necessitate upgrades.

The physical clues found in the styles of current mouldings of doors and window surrounds, as well as hardware and fasteners discussed later in this work an origin period as early as the 1840s, however situational variables need to be taken into consideration. While the

[29] "Thomas Ross" File in tax parcel folder 42-36-062 located at the Solebury Township Historical Society. Accessed January 10, 2018.
[30] Harmon Yerkes, "John Ross and the Ross Family" in *A Collection of Papers Read Before the Bucks County Historical Society*, Vol. 2, read January 21, 1896, (Easton: The Chemical Publishing Company), 356.
[31] Ibid, 356-357.
[32] Ibid, 358.

styles and manufacturing methods of these features can be used to assign possible dates of origin, they merely indicate the earliest possible date of implementation. The rural nature of the site would likely cause a lapse between the time of manufacture and use in construction due to slow dissemination along trading routes from Philadelphia. In conjunction with this, farmers would likely not be spending money on the most in-vogue styles of woodwork for their practical farms, rather more likely purchasing somewhat outdated mouldings, fasteners, and hardware at discounted prices. This is a probable situation that Edward Van Sandt was faced with when it was likely necessary to do a major overhaul of the entire house's wooden components. Physical investigation of the current windows, doors, and surrounds suggests that they most likely date to this mid-nineteenth century construction campaign. It also appears that Van Sandt added the third story at this time, evidenced by another construction seam on the north façade and the different style and shape of the third story window penetrations. Though now non-existent, several wooden additions on the south façade and a small connected outbuilding on the west façade visible in photos from 1938 were likely added during Van Sandt's ownership, as he was one of the longest-running tenants of the house and invested significantly in its upgrades (Figure 11). Not only the house, but the surrounding property was upgraded during Van Sandt's ownership. The nearby covered bridge, built in 1875 to span Pidcock Creek, allowed greater connection to trade routes and nearby town centers and was named for this owner and is now on the National Register of Historic Places.[33]

[33] Susan M. Zacher, "National Register of Historic Places Inventory Nomination Form: Van Sant Covered Bridge", Accessed April 20, 2018.

Figure 11. Photograph of the south façade as the Raymonds first encountered it, including wooden additions off the south and west masonry elevations. Source: Raymond Collection, University of Pennsylvania Architectural Archives.

Van Sandt's updates to the house were likely implemented soon after he purchased the property in 1853, and he utilized the house and farm until his death in 1885. For some reason, the executors of his estate did not sell the property until 1922, and it is unclear whether it remained empty during this nearly 40-year period or was inhabited by his heirs. The next owner, Charles W. Pidcock, purchased the property for a mere $6,500 in 1922, almost $2,000 less than what Van Sandt had paid for the property in 1853, inferring that it was likely in a dilapidated state.[34] Pidcock inhabited the house until his death in 1936. The subsequent owners, Tyson and Sally Nimick purchased the property in 1937 for $11,500. Census information indicates that the Nimicks lived just down the road from the farm on Old Windy Bush Road in 1940, and also notes

[34] Ned Harrington, Deed research file in tax parcel folder 42-36-062 located at the Solebury Township Historical Society. Accessed January 10, 2018.

that they lived in the same house as in 1935.[35] It is therefore likely they purchased the property to expand their farming acreage rather than to inhabit the house. The Nimick ownership was short-lived, as they sold the property to Antonin and Noémi Raymond in 1939 for a nominal amount.[36] Whether this arrangement was due to an agreement between the Raymonds and the Nimicks or a possible foreclosure is not clear at this time.

2.3.2 Raymond Ownership and Intervention

The farmhouse has the good fortune to have been purchased by historically-minded people who recognized the importance of documenting their process both before and after. Among archival documents, two photos were found that show the north and south façades of the building as the Raymond's first encountered them. These photos show several wooden additions on fieldstone masonry foundations or piers, consisting of both a front and rear porch, a southern two-story living addition, and a western ell that extended toward the barn and likely stored farm equipment based on the open south façade. It is unclear exactly when these additions were constructed, though they likely follow the pattern of slowly expanding rural structures in accordance with the needs of the farm or family. Antonin's autobiography recalls, "The house and the barns, of course, were changed and added to many times during the two centuries, but still retained a great deal of charm, which I respected when making it suitable to our needs in giving it a certain touch of the Orient with which I was imbued."[37] These exterior photos also show a higher percentage of the façades being covered with a stucco parge, which is extant today but over much a reduced surface area.

[35] *U.S. Census*, 1940, Solebury, Bucks, Pennsylvania, page 1-A, Enumeration district 9-77.
[36] Ned Harrington, folder 42-36-062.
[37] Antonin Raymond, *Antonin Raymond: An Autobiography*, 172.

These two photos are not the only documentation of the structure prior to the Raymond intervention, drawings found in the Raymond family's personal collection show the as-found layout of all three floors, as well as the north façade (Figure 12). It should be noted, however, that the wooden additions were not recorded in this campaign, only the rectangular plan of the house's stone envelope. Though not pictured, the southern living addition appears to have had access from the interior through a first and second floor portal. The Historic American Building Survey (HABS), which began in 1933 in order to document America's architectural heritage was likely a variable in the Raymond's push to document the house before they made major alterations. These drawings are signed by H.H. Stevens and are dated April 27th, May 20th, and June 5th, 1939 and are currently held by the Raymond Family. This extended documentation campaign implies the depth of concern the Raymond's felt to preserve the memory of the previous layout of the building, which had been utilized as a practical farm house for about two centuries before its purchase and their occupation.

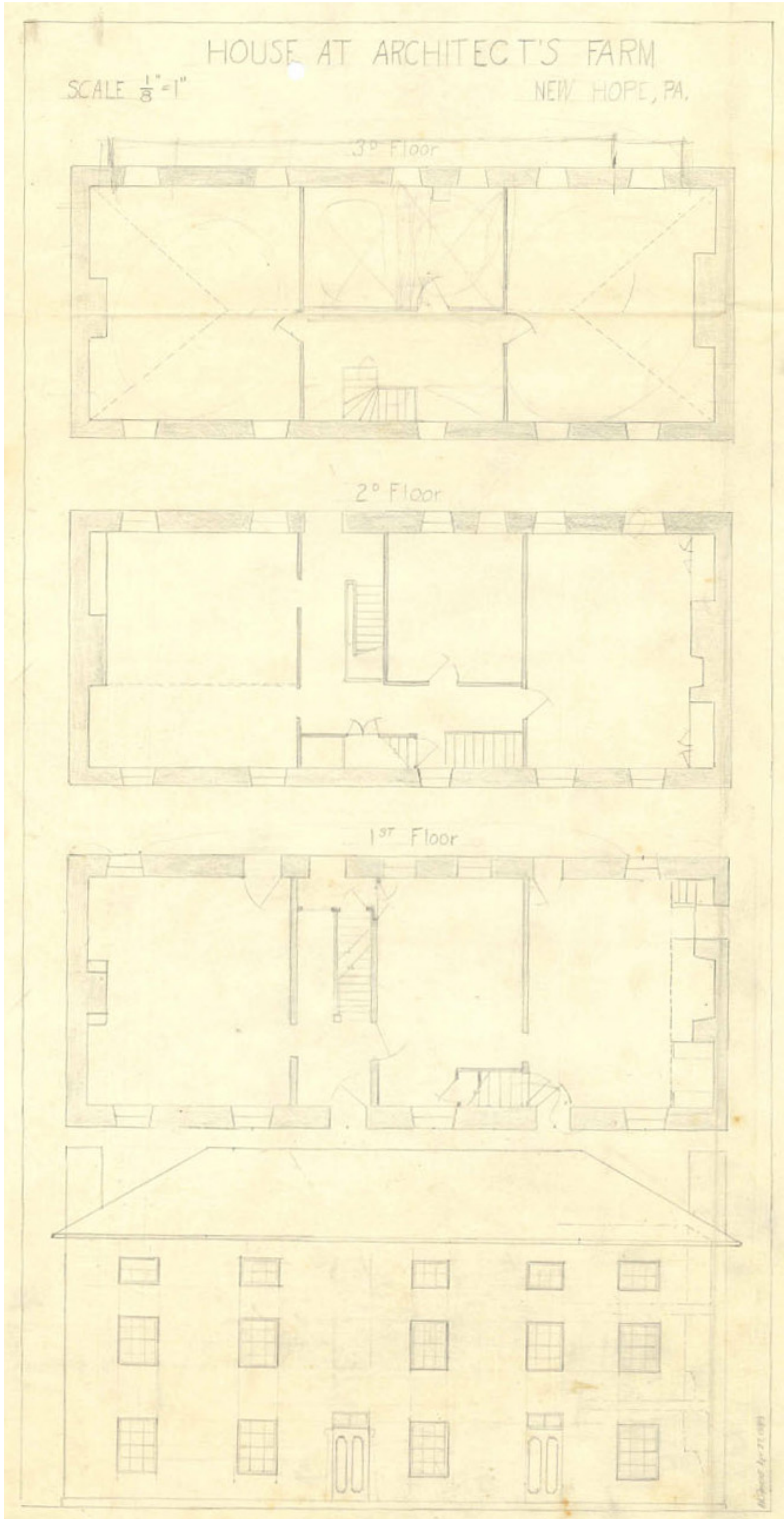

Figure 12. Pre-Raymond floor plans by H.H. Stevens, April 27, 1939. Source: Raymond family-held drawing collection.

While the Raymond's had worked quite successfully in Japan for nearly two decades and gained international renown as a design team as described in the previous section, remnants of the Depression and the onset of World War II put a heavy damper on their financial situation due to reallocation of resources and a population in fear of the increasing global tensions, both of which contributed to a design and building lull in the pre-war years. Though the purchase of a working farm served as an opportunity to balance the Raymond family financially, the idea of creating his own Taliesin-like experiment was also pre-conceived. In a letter to the Japan office, Antonin writes, "I am buying a big farm in Pennsylvania and I will start a modern architecture school there. It is not certain but very likely. There are many young architects that want to work with me."[38] This intent was echoed by Noémi in a similar letter sent the next month, "It will interest you to know that we have bought a farm in Pennsylvania, which if all goes well should develop into an "art" center, the marvelous old barn being used for studios and work shop and the cows kept in the stables below."[39] It should be noted that it was not simply architecture and drafting that the couple intended to teach, but also art and design influenced by the rustic lifestyle. The deed was officially signed over to Antonin and Noémi on May 16, 1939. [40]

After purchasing the property and completing some initial documentation drawings and photos, the Raymonds began the major effort of blending the Bucks County Quaker vernacular architecture with Japanese design in accordance with their own modernist principles. In order to achieve their vision, there was much work to do both on the envelope and in the interior, Antonin notes "The fields and the house and the other buildings were all in a very dilapidated

[38] Antonin Raymond, Letter to Japan Office, March 19, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.
[39] Noémi Raymond, Letter to Japan Office, April 6, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.
[40] Office of the Recorder of Deeds of Bucks County, Deed book 677, page 628 (Tyson and Sandy Nimick to Antonin and Noémi Raymond, May 16, 1939).

state. The fields were exhausted and eroded and the fences down."[41] The only currently known photo showing what the interior might have looked like is one where Claude, their son, is assisting in the reopening of a fireplace on the east end of the first floor. The house's interior as it was then did not yet offer many comforts such as modern heating. Antonin describes their living situation in his autobiography, "At the beginning we established ourselves in the old barn and slept there on army cots, meals being cooked on an open fire outside."[42] Though she had mentioned a homesickness for Japan in many previous letters, Noémi writes to the Japan office at the beginning of construction, "For it is true that I am not unhappy here in spite of everything being so totally different. There is a wonderful sense of freedom, and also of there being so much to be done. Things are very crude and imperfect but one feels that one is working to found a new civilization."[43] Antonin acknowledges her effort in his autobiography, "Noémi cooked, washed dishes, did laundry and in every other way acted as a farmer's wife besides doing her design work. It was a truly great effort on her part."[44] In a later letter to the Japan office, it is clear that Noémi is also busy planning the interior design. She states she is interested in seeing how Japanese furniture might hold up under American weather conditions and orders several pieces to be made and shipped to New Hope. She also requests samples of woods, veneers, bamboo and reed sudare [hanging mats], and fibre cloth. She claims, "We find that although one can get almost any wood from anywhere in the world in New York, there are none from Japan."[45]

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[41] Antonin Raymond, *Antonin Raymond: An Autobiography*, 172.
[42] Ibid.
[43] Noémi Raymond, Letter to Japan Office, May 1, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.
[44] Antonin Raymond, *Antonin Raymond: An Autobiography*, 172.
[45] Noémi Raymond, Letter to Japan Office, June 27, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.

For the work on the building envelope, the farmhouse was already oriented in a beneficial direction, with a long elevation facing the south. The Raymond's plan took advantage of this orientation. Antonin explains,

> "The Japanese house faces the south and is entirely open on this side; that is to say that the house is nothing more than apertures and pillars, engulfing the cool breezes in summer and the sun in winter (which is the only way of warming the house). Apertures necessary for venthilation are made on the north side without which everything would become musty and also to give a view onto the shady side of the garden. Our plans are oriented according to these traditions, which are perfectly logical."[46]

Their scope included the demolition of the wooden additions on all elevations, removal of a large portion of the southern stone façade on all three floors to allow for large glass doors and windows, enclosure of the front porch to act as a *genkan*, as well as the construction of a new wood wing on the eastern end of the structure. In a letter to the Japan office in June, Noémi writes, "We shall very soon be able to send you pictures of the farm in Pennsylvania which we hope will be a shelter from this war ridden world."[47] A few photos were sent shortly thereafter and offer a glimpse into the construction process. One photo of the south exterior shows the scope of stone removal, as well as the bracing used for the new eastern wing (Figure 13). Another photo looking west in the interior shows the retention of not only the front and rear doors, but also the niche cupboard, partitions to either side of the fireplace, the joists and flooring boards in the western second story room, and even the closet door in the second story room is visible. The same photo shows the beginnings of the light well through the second floor, and the main hall staircase in its new position against the north wall with unfinished flooring

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[46] Antonin Raymond and Noémi Raymond, "On Japanese Residences (1935)", in *Crafting a Modern World: The Architecture and Design of Antonin and Noémi Raymond*, ed. Kurt G. F. Helfrich and William Whitaker (New York: Princeton Architectural Press, 2006), 280-281.
[47] Noémi Raymond, Letter to Japan Office, June 27, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.

surrounding it and extending throughout the rest of the second floor (Figure 14). Though few in number, these photos are indispensable in assisting with creation of the chronology of the house and its interior elements. Antonin states, “It was a liberation for all the young architects to see with what freedom we handled the redesign of our buildings: entirely free from accustomed practices but with profound respect for anything beautiful that was still left in the buildings which we had inherited.”[48]

Figure 13. Construction photograph of the south elevation showing areas of the masonry envelope that were removed, and the new wood addition on the east façade. Source: Sugiyama Collection, University of Pennsylvania Architectural Archives.

[48] Antonin Raymond, *Antonin Raymond: An Autobiography*, 172.

Figure 14. Construction photograph of the first-floor interior showing the unfinished ceiling, and a glimpse of the second-floor closet doors is available through the new light well. Source: Sugiyama Collection, University of Pennsylvania Architectural Archives.

Work on the farm continued, and in the fall, Antonin decided to greatly restrict his time at the New York office and move nearly all operations to the farm. “Our house in Pennsylvania is only half finished although I’ve worked awfully hard – but we are moving this week – It will be cold and dreadful for at least a month but shikata-nai [Japanese for “It can’t be helped”]– we must move. After the window frames are in I will take measurements and will ask you to order the shoji in Japan and send them.”[49] In a letter about a month later, Noémi describes the farm’s seven residents, then a Polish architect and his wife, a young engineer, a farmer from Virginia and his assistant, a cattle herd from Texas, and of course Antonin and Noémi.[50] It appears that Claude was not with them at this point due to the unfinished nature of the house, however things were coming together. Another letter soon after notes that the house finally had installed a source of heat.[51] The Raymond plan introduced a hot water heating system located in the

[49] Antonin Raymond, Letter to Japan Office, September 28, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.
[50] Noémi Raymond, Letter to Japan Office, November 1, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.
[51] Noémi Raymond, Letter to Japan Office, November 9, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.

basement with radiators in several of the upstairs rooms, however the ground floor employed an inventive design: a series of radiators in the basement just below the first floor level that distributed their heat through openings covered by wooden grilles inset into the floor, effectively hiding the heating source along the opened southern façade and opening the viewshed out the long panel of sliding glass doors. On upper floors the Raymonds utilized a type of sliding glass window that was patented under Antonin's name, which utilizes metal rollers along a metal track.[52]

While the couple was unable to remove their money from the Japanese banking system to be sent to America, they were able to use the funds to purchase items in Japan. Antonin sent away to his Japan office to order *shoji* and *fusuma* screens to be constructed in Japan with their funds and shipped over by boat, and eventually rail, to New Hope. He instructed the *shoji* to be papered in Japan, and "Fusuma to be without outside frame and be either covered with cloth, Mr. Yoshimura to select cloth, or if that is not available now, to be covered by handmade paper like Karuizawa – our house has ceilings and walls all of cedar (beisugi), no finish, so Mr. Yoshimura will know what to use."[53] This is one of the first references of their preferred style at the farmhouse, and also calls out the specific species of cedar used, as beisugi is also known as Thuja plicata, commonly known as the Pacfic Red Cedar.

2.3.3 The New Hope Experiment and Beyond

With the farm house mostly complete, the couple began what was later titled "The New Hope Experiment".[54] Like Wright's Taliesin, the Raymonds wanted to mentor young talent, and

[52] Antonin Raymond, *Window Construction*. U.S. Patent 2,282,885. Filed June 23, 1939 and issued May 12, 1942.
[53] Antonin Raymond, Letter to Japan Office, November 19, 1939. Raymond Collection, University of Pennsylvania Architectural Archives.
[54] New York Architectural Critic Frank G. Lopez coined this phrase in "Perspectives: The Diffident Gascon, Antonin Raymond" in *New Pencil Points* 25 Part I (June 1944): 73-74, and Part II (July 1944): 64.

advertised to attract younger apprentices that might propagate their design principles. The December 1939 issue of Pencil Points announced that Raymond would take on apprentices who shared his view that "truly creative work finds its real basis in nature, in freedom, in reality, and hard work."[55] Architectural Forum editor Henry Saylor visited the site and claimed that Raymond would be "supplementing the deficiencies in current American architectural training."[56] Apprentices would be expected to tackle real-world design and construction issues in the large first floor drafting room, participate in hands-on construction projects, and discuss economics, craft, and other subjects relevant to becoming a well-rounded professional architect during portions of the day, and assist with farm work in order to stimulate physical activity and earn their keep. Though the number of apprentices varied over the course of the New Hope Experiment, apprentices included Yoshimura Junzô from their Japan office, Elsa Gidoni, Kazimierz Dziewoński, and Hermann Field, encompassing the fields of design, planning, geography, and architecture.[57] The Raymonds also accommodated a range of visitors to their house/studio including artists, scholars, and diplomats. Prominent architects such as Eero Saarinen and Alvar Aalto also frequented the site, allowing apprentices to ask questions about art and design during mealtime discussions.[58]

Though developed to introduce apprentices to real-world problems, the very real problem of an impending World War II brought the New Hope Experiment to an early close, as Antonin was then contracted by the American government on several defense contracts, particularly prefabricated buildings for military use.[59] Though somewhat reluctantly, he also

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[55] "Raymond Will Take Apprentices", *Pencil Points* 20, supplement (December 1939): 4.
[56] Henry H. Saylor, "Diary Entry for 15 May 1940", Architectural Forum 74 (June 1940): 436.
[57] Kurt G. F. Helfrich, "Antonin Raymond in America", 50.
[58] Ibid.
[59] Ibid, 53.

participated in the construction of a series of Japanese-style houses for test bombing.[60] While Antonin was travelling to fulfill these contracts, Noémi remained in New Hope and continued to produce textile designs and complete other projects. She even set up a loom in the first floor to produce her own designs, and the loom is still present in the basement of the house.

Perhaps the most significant event of these wartime years at the farm centered on the Raymond's relationship with George Nakashima, who had worked with the Raymonds in their Japan office, and upon his return to America had been interred with his family at the Minidoka internment camp in Idaho. Though George was an American citizen, his Japanese ethnicity forced his entry into this camp, where he met Gentarô Hikogawa, a Japanese carpenter who taught him to master traditional hand tools and joinery techniques.[61] The Raymonds successfully sponsored the Nakashima family's release from the camp in 1943 and invited them to their New Hope home to fulfil the requirements of this sponsorship. The Nakashima family stayed in a third-floor room, and it was here that George began experimenting with the expressiveness of wood utilizing natural knots and burls to create his distinctive style of furniture. Inspired by the New Hope landscape, the Nakashima family later acquired land not far from the Raymond Farm and set up their own atelier and furniture making studio.

After the war, both Antonin and Noémi returned to Japan, knowing full well that the country would need rebuilding after suffering huge losses to American bombing campaigns. The couple spent their time between their Japan and New Hope studios. The experimentation with the synthesis of Japanese and vernacular architecture in the Modernist vein proved to be the fodder for several of their later works, where they attempted to streamline their design and

[60] Antonin Raymond, *Antonin Raymond: An Autobiography*, 188-189.
[61] Yukio Tazuma, "A Master Craftsman from Minidoka", *North American Post,* November 4, 2009, 3.

technique. Today Antonin is considered one of the founding fathers of Modernism in Japan, and Noémi as one of the pantheon of women designers celebrated at the Museum of Modern Art.[62] Though Antonin passed away in 1976 and Noémi in 1980, their grandchildren and great-grandchildren grew up in or frequenting this house and are now in the process of conserving the site to maintain its cultural significance.

3. Methodology

3.1 Physical Investigation

The physical investigation of the farm house begins with analysis of many components, including fasteners such as nails and screws, hardware including door handles and hinges, as well as architectural mouldings. Several scholars have created stylistic and technology-based chronologies based on known manufacturing procedures and data acquired from sampling from a pool of houses with known construction dates. One of the pioneering studies of this kind was conducted by Henry C. Mercer in 1923, in which he surveyed elements of 166 structures including barns, meeting houses and residential properties and proposed date ranges for each type. Aside from six structures located in Philadelphia, the rest of the houses in the sample pool were located in Bucks County and they were generally farm buildings.[63] While this study set an initial framework that was built upon by later scholars, it has been proven to be incomplete, though despite this his study still contains important documentation of the region and period in focus and is therefore still relevant to this particular archaeological analysis. Several other

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[62] "Noémi & Antonin Raymond", The Raymond Farm Center for Living Arts and Design, accessed April 23, 2018. http://www.raymondfarmcenter.org/theraymonds

[63] George F. McNulty, "Henry C. Mercer and Dating by Mouldings" Bulletin of the Association for Preservation Technology, Vol. 10, No. 4 (1978): 16.

studies that investigate hardware, fasteners, and mouldings were utilized to inform the chronology proposed in this report.

Other investigation involved gathering physical samples for testing, such as gravimetric mortar analysis, which allows conservators to not only determine the type of sand used, but also reveal the acid-soluble binder to aggregate ratio, which informs future pointing campaigns. Intangible data was also gathered by specialized diagnostic tools like environmental data loggers and an infrared camera. Monitoring environmental conditions such as temperature and relative humidity provides context for creating treatment recommendations and an overall conservation plan with regard to environmentally-sensitive materials such as wood and finishes. Infrared thermography has been used in buildings to determine overall energy efficiency and also to locate the sources of air and water leaks in the building fabric via analysis of temperature variances on the surface of the materials. While these processes of dating architectural features, environmental monitoring, and infrared thermography can assist in understanding the building's current condition, it should be remembered that these are somewhat inexact sciences and their interpretation can be flawed, however they have proved to be more beneficial than detrimental in the past with regard to creating chronologies and conservation plans.

3.1.1 Fasteners

Developments in the field of fastener manufacture allow certain architectural elements to be dated with a degree of accuracy based upon the idiosyncratic details that arise due to method of production. Nail manufacture, for instance, has developed greatly in the past few centuries and there have been several attempts at creating chronologies based on features inherent in the nail from the manufacturing process. Mercer discussed nails in his chronology, however his groundbreaking work in this area of study were sometimes generalizations, and later scholars have built upon this framework with more exacting detail. Another landmark study that furthered research in this field of architectural archaeological analysis was written by Lee H. Nelson in 1968 which describes the manufacturing processes in greater depth and develops a more detailed list of analyzed features, yet this too had areas of incomplete information. Perhaps the most comprehensive study to date was written by Tom Wells in 1998 that identifies twelve different types of nail based upon nine diagnostic features including metal type, manufacturing method, grain (iron only), point (cut only), head manufacture, burr (cut only), pinch (cut only), shaft taper, and shaft section. All of these studies are largely based upon technological changes in manufacture that in turn leave distinctive features in the nail's anatomy and each made giant steps in chronicling our understanding of the technological development of nails. Future research in this field of study can potentially refine these works further to provide the most accurate dating information possible, however all three remain essential for architectural historians and conservators to most accurately gather information about the built environment.

Hand-made wrought nails were the most basic of nail types and have been used since the advent of the technology in the Bronze Age. Wrought iron, which is made of mostly pure metallic iron combined with siliceous slag, was drawn out into long bars and then supplied to a nail maker or blacksmith. Because of the drawing out process, first accomplished by manual labor and water-powered helve hammers then later by rollers, these bars had a wood grain-like texture longitudinally due to the elongated cooled slag.[64] Nails were then manufactured by a blacksmith or specialized nail maker by hand-working these bars by hammering one end on all four sides to a point, cut, and hand headed by inserting the worked end into a vise or hole in the

[64] Tom Wells, "Nail Chronology: The Use of Technologically Derived Features", *Historical Archaeology* 32(2) (1998): 80.

anvil and hammering the top to spread into a head shape.[65] This heading process resulted in a distinctive mushroom-like head, sometimes called a “rose head” These wrought nails have a relatively square shaft dictated by the original bar, taper on all sides to a point, and are generally not uniform due to their handmade nature.

Hand-making nails was a laborious and tedious task, and advances in machinery eventually created a cheaper and more efficient process resulting in the cut nail. Cut nails were created by feeding a rectangular iron nail plate through a machine that cuts the plate at an angle to create a truncated triangle blank. All cut nails therefore taper on two sides, the cut faces, and have a uniform thickness below the pinched area.[66] Small burrs, slightly raised edges, are caused by the cutting process and the location of can be used as a diagnostic feature. Early cut nails were made from iron plates created by narrow rollers, resulting in nails with a rounded head caused by the shape of the plate, and a lateral grain, which caused breakages when clinched, bent, or extracted (Figure 15). These plates were hand-fed through the cutting machine, and the inaccuracies of repositioning the plate created a burr on opposite sides. The blanks where then put into a clamp and headed by hand. Production of cut nails was made streamlined and the finalized products made more uniform with advances in water and steam power, which resulted in speedier production as well as the creation of larger iron rollers. Wider rollers allowed the nail plates to be cut from larger sheets, creating a stronger nail with an in-line grain and a flat point (Figure 16). Reciprocating cutters and automated feeding of the plate into the cutting machines also gave rise to nails with a burr along the same side. These nails were then clamped mechanically, creating a deformation known as the pinch, and headed by

[65] Henry C. Mercer, The Dating of Old Houses”, in *A Collection of Papers Read Before the Bucks County Historical Society*, Vol. 1, read April 21, 1885, (Easton: The Chemical Publishing Company), 238.
[66] Tom Wells, “Nail Chronology: The Use of Technologically Derived Features”, 83.

machine, creating a small square or rectangular head. Grain-in-line cut nails made with nail plates created with wide rollers appear to have become common in the 1830s. The more modern type of drawn wire nail began to be produced as early as 1875, however commercial production was not initiated until 1880. These types utilized wire that fed into a machine that clamped the wire, creating lateral scores under the head, which was created mechanically. The point is then created by cutting dies that separate the nail from the main body of the wire, generating the finished nail.[67] Iron wire was utilized at first, with steel wire overtaking the industry by the early 1890s. Wire nails eventually overtook the market, and though cut nails were still in production in the early 20th century, they only represented about 8% of nails used in 1920. Wire nails are still in production today and are therefore not necessarily a useable tool for dating purposes, the only inference that can be made is that it was made after 1880.

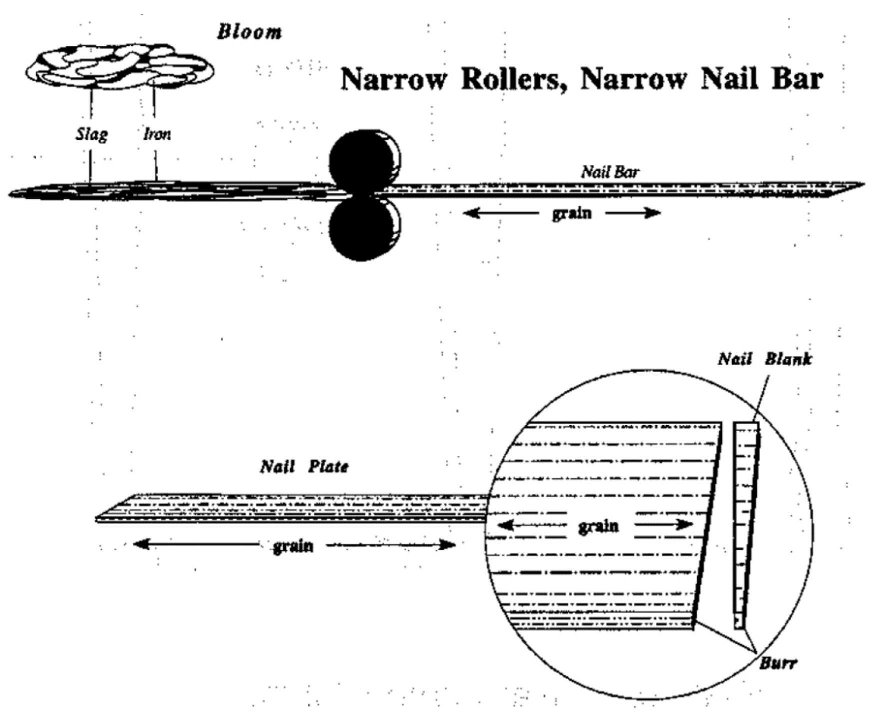

Figure 15. Early nail plates produced using narrow rollers created a slag grain crossing the blank laterally. Source: Nail Chronology: The Use of Technologically Derived Features by Tom Wells.

[67] Ibid, 86.

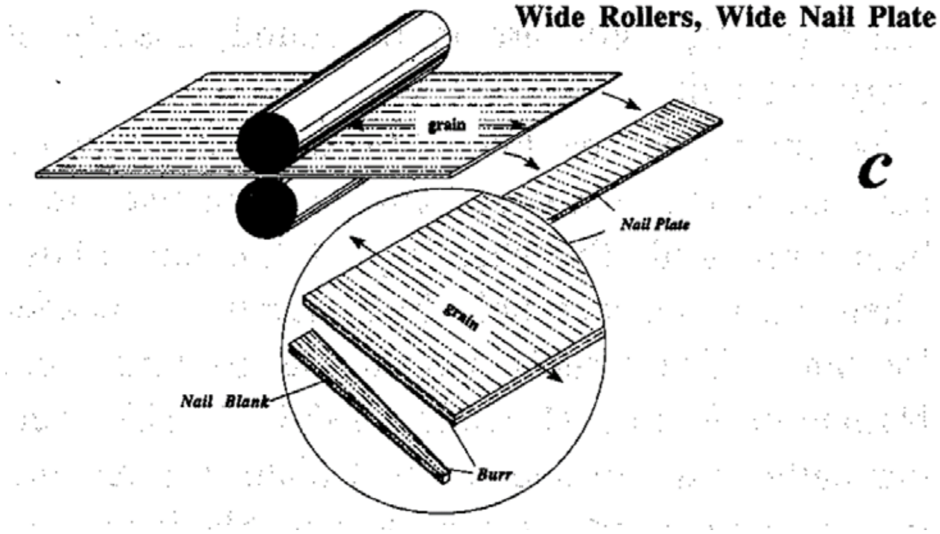

Figure 16. Later nail plates created by the use of wide rollers and an extra cut. This technology resulted in flat points and an in-line grain longitudinally along the blank. Source: Nail Chronology: The Use of Technologically Derived Features by Tom Wells.

Nails extracted from the Raymond farm house include all types, wrought, cut and wire, reflecting the evolutionary nature of the structure. A singular wrought nail was pulled from a northern interior window surround where material loss of the wood exposed the head and a black iron stain was being created by corrosion of the nail. This nail tapers on all sides to come to a distinct point (Figure 17). Unfortunately, corrosion obscured the head type and caused the top of the head to delaminate from the body of the nail upon extraction. Though corrosion covers the majority of the nail creating lateral striations, the wood-like in-line grain is visible, confirming it to be wrought.

Figure 17. Nail extracted from the interior window surround of the window to the east of the front door on the north facade. Technological features indicate this is a wrought nail. Source: Author.

A detached piece of applied moulding belonging to the standalone southern door on the first floor proves to be a useful feature to be used in the dating process by examination of both the nails and the moulding itself. These nails are smaller yet have dateable diagnostic features. These nails are classified as cut based upon the taper on only two sides, and a rounded point. While not readily visible to the naked eye, small burrs on the same side of the nail can be seen when viewed under magnification (Figure 18). The cross-grain can be seen along the longer face of the nail, which identifies it as a likely type 5 or 6 nail from the Wells chronology (Figure 19). The only feature of these nails that differs is the pinch, however these nails are still embedded in the detached piece of applied moulding, therefore head type and pinch are not able to be discerned. Both types 5 and 6 were in production roughly around the same time, from 1805-1840, which falls in line with the general trend of the older types found due to slow dissemination to the rural areas, and this information points to use in the 1850s Van Sandt building campaign.

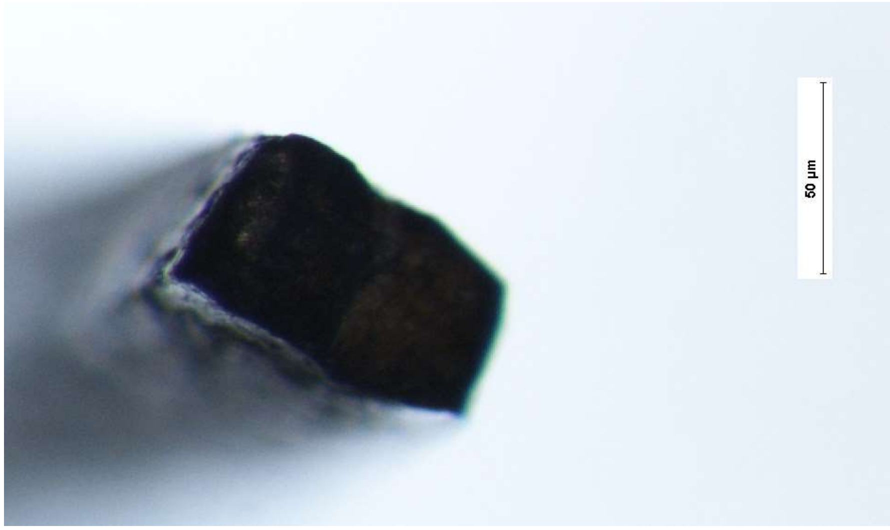

Figure 18. Small Burrs appearing on the same face of the same cut nail in Figure 18. Magnified 10x. Source: Author.

Figure 19. Cross-grain visible on a nail embedded in a piece of detached applied moulding. Magnified 10x. Source: Author.

The fasteners that penetrate through the first-floor boards into the basement were investigated and appear to be mostly cut nails, with a very small percentage of more modern wire nails in select areas. One of the flooring nails was extracted and examined, and shows a taper on only two sides, flat point, which are indicative of most styles of cut nails, however the nail is face-pinched, burrs are located on the same side, the head is uniformly thick and sturdy, and the grain direction runs longitudinally (Figure 20). These features match the nail type 8 described in Well's nail chronology, which saw use in Louisiana between 1820-1890. While this is a large date range, it was likely implemented during the 1850s Van Sandt building campaign, as any other owners would have been working in an era of readily available wire nails. While the earliest dates associated with this type of nail predate this construction campaign, the rural nature of the house likely prevented quick dissemination of construction materials. Therefore, nails that had been produced almost a decade before might just be introduced in the New Hope area market much later than more urban centers. While the Raymonds were historically minded in their intervention of the house, cut nails are much costlier than wire nails during their intervention. Correspondence between the Raymonds and their Japan office during this construction phase convey a sense of financial stress, so it is very unlikely that they would have invested in reproduced cut nails to use in the flooring. Aside from the rectangular-headed cut nails described above, two flooring brads with a characteristic L-shaped head are present in the second-floor west bedroom's floor. These types of brads begin to appear in the early 1800s and are prominently used for flooring, however they continue to be produced through the present, therefore dating based solely on these nails is not advised.[68] However, this knowledge combined with the use of other cut nails in the lumber one can infer that the earliest dates of implementation are the early 1800s.

[68] Lee H. Nelson, "Nail Chronology as an aid to dating old buildings", *History News* Vol. 23 no. 11, (November 1968): 208.

Figure 20. Cut nail extracted from the first-floor boards. Diagnostic features described by Wells indicate this nail was likely produced between 1820-1890. Source: Author.

The evolution of the shape and details of wood screws can also inform potential fastener dating methods. Though wood screws had been used since the early 15th century, they remained handmade and relatively expensive until the advent of the lathe-turned screw around 1760.[69] Hand-made screws are distinctive in that they show file marks, are often irregularly shaped, and sometimes have an off-centered slot. Lathe-turned screws were produced more uniformly, and like the nail manufacturing process, early screws were hand-headed until eventually a method to head the screws as they were rotating on the lathe was produced circa 1837.[70] Evidence of machine-headed screws appears in the form of circular marks on the bottom of the head. Screws of this period tend to taper only slightly and did not come to a distinctive point until the introduction of the gimlet point screw in 1846.[71]

A screw removed from the butt hinge of the southern door with the detached applied moulding supports the evidence from the moulding and nail that infers that it was put into place in the 1850s Van Sandt building campaign (Figure 21). The head shows circular marks on the underside indicative of machine heading, has a very slight taper, and terminates in a blunt edge

[69] Christopher White, *Observations on the Development of Wood Screws in North America*, 2009, 2.
[70] Ibid.
[71] Thomas Sloan *Wood Screw*. Patent 4,704. Filed August 20, 1846 and reissued February 22, 1848.

rather than a point, signifying that it was likely produced between 1837 and 1846. Again, the rural nature of the site likely kept this screw from being disseminated to the area until slightly later than was the norm. This hinge utilizes all screws of this type, cementing the likely date ranges for the piece. A screw with the same diagnostic features was also extracted from the hinge of the southern batten door on the west interior elevation, however other screws from the hinges of these doors proved to be post-1846 gimlet screws, indicating that they were likely rehung later than 1850.

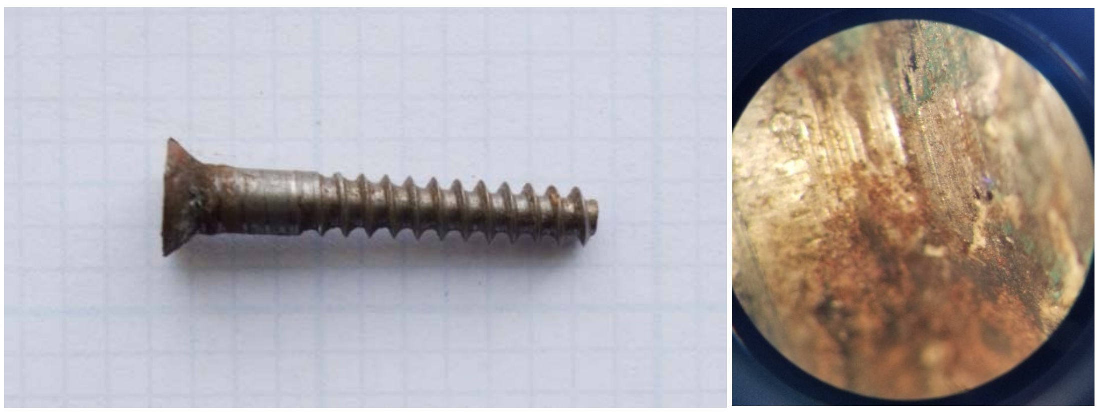

Figure 21. Screw extracted from the main southern door on the first floor. The blunt tip and circular marks under the head (right) indicate it was made sometime between 1837-1846 when the advent of gimlet pointed screws made these obsolete. Right image magnified 10x. Source: Author.

Modern styles of screws are found in the known Raymond campaign, including the lightwell fusuma tracks, some areas of the interior woodworking, as well as in the butt hinges of many interior doors (Figure 22). Though the wooden elements of the main stair from the first to second floor have been determined to likely be a part of the 1780s campaign, modern screws were extracted from it, acting as another indicator that the stair was moved to its present location during the Raymond campaign (Figure 23).

Figure 22. Screw extracted from the mezzanine-level fusuma track that creates the division between the hallway and lightwell area. Source: Author.

Figure 23. Screw removed from the stair baluster railing on the second floor showing machined head and gimlet point, indicating the likely manufacture date to be post 1846. Though the woodwork is likely from the 1780s campaign, the presence of modern screws supports the hypothesis that it was moved to its current location during the Raymond campaign. Source: Author.

3.1.2 Hardware

Architectural hardware in the form of door handles, hinges, latches, and locks also inform chronologic evolution of the house. Some of the most primitive hardware are the simple wooden pull knobs on the first-floor niche cupboard doors. These doors do not utilize any latching system, only simple geometry combined with excellent craftsmanship keeps them closed. While the handles themselves appear to be primitive and likely from the 1780s campaign, the northern handle has been reattached using a modern screw. A simple wooden latch is present on the closet of the eastern second floor bedroom, indicating that it is also likely from the 1780s campaign, though it is currently being held together with modern wire.

Multiple sources state that the use of Suffolk thumb latches was prevalent through the Colonial period through beginning of the 19th century.[72] These Suffolk latches utilized two cusps that lay flat on the door and were connected by a round or semi-round handle. While the styles of the upper and lower cusps varied, the most common type of cusp style was shaped like a lima bean (Figure 24). The singular element of these thumb latches that have been used for dating purposes is the shape of the lift, which appear to be straight before 1800 and have a curved lift after that time. Why this change occurred is unclear, however some records state that the straight lifts were sometimes difficult to open. Both doors on the western wood partition on the first floor show a ghost of this bean handle, however it is unclear when they were removed or when they may have been implemented because the lift is no longer available for examination. Instead, a sliding latch has been added to the interior sides of the doors. Though worked to appear old, this hardware is likely of modern origin based on the shape and fasteners.

[72] Rlene Howell, "Craftsmanship in Wrought Iron", The Metropolitan Museum of Art Bulletin. Volume 9, Issue 3 (1950), 83.

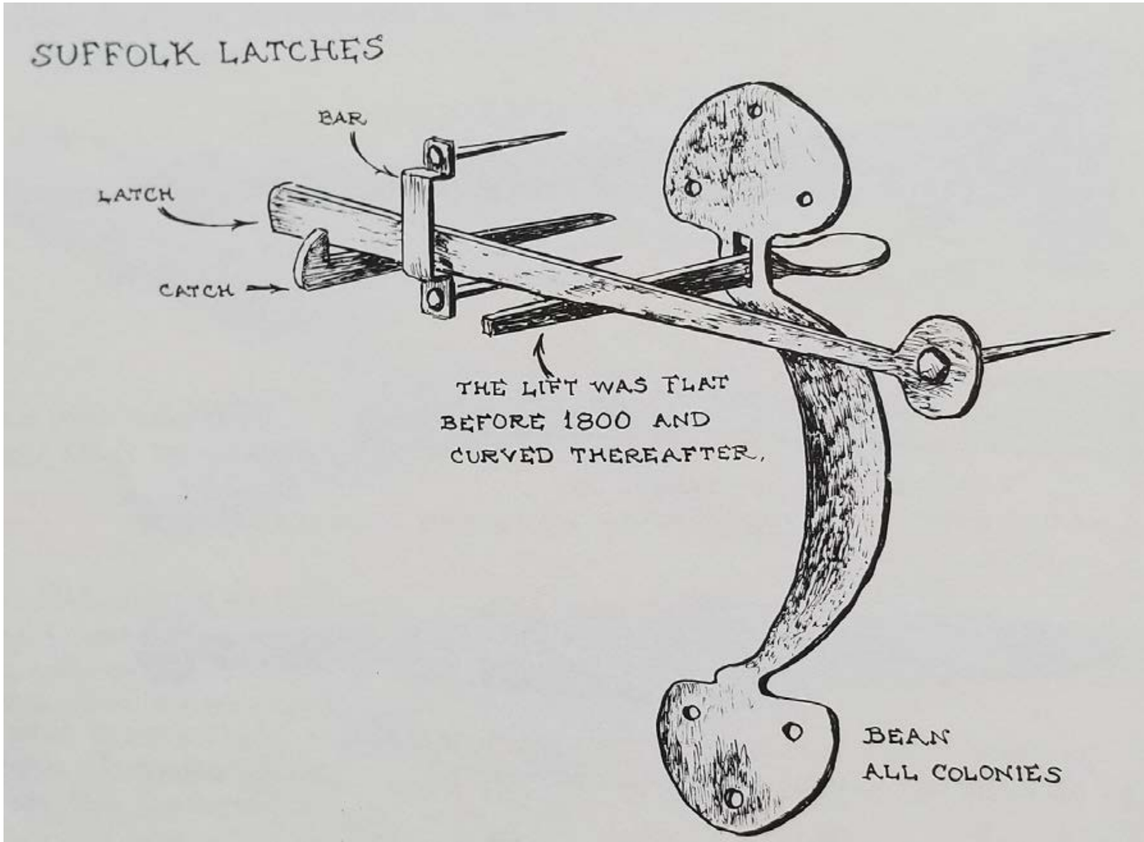

Figure 24. Typical thumb latch style with bean-shaped cusps. Before 1800 the lift was straight, after 1800, it becomes curved. Source: Home Building and Woodworking in Colonial America by C. Keith Wilbur, 1992.

While early Suffolk latches were wrought, cast iron latches came into use as early as the late 18th century.[73] Other thumb latches on several interior doors utilize a curved lift, however the smoothness of their metal and the newness of their fasteners indicate that they were cast rather than wrought and are likely modern reproductions of this style of thumb lift. The one exception of a thumb latch that appears to be from a pre-modern era is present in a closet door on the third floor to the west of the stair. This latch appears to be a cast Suffolk latch, showing a coarse finish, and a downward turned lift, indicating it was produced after 1800 (Figure 25). The cusps are trefoil shaped, which was a popular style in the New Jersey area.[74]

[73]Donald Streeter, "Early American Wrought Iron Hardware: Norfolk Latches", *Bulletin of the Association for Preservation Technology*, Vol. 3, No. 4 (1971), 12.
[74] Eric Sloane. *A Reverence for Wood*. (New York: Funk & Wagnalls, 1965), ??

Figure 25. Cast iron thumb latch located on a third-floor hallway closet. The downturned lift indicates it was produced after 1800. The handle is on the interior, indicating the door was moved to its current position in the Raymond campaign. Source: Author, March 16, 2018.

With origins in the Medieval period, the H hinge was the most used style of hinge hardware through the Colonial period.[75] H Hinges were usually hand-wrought iron that were fastened to the door and surround either by relatively expensive wood screws or by clinching the nails, thus making the door difficult to remove. The distinctive shape of these hinges allowed for the nails to be spread out over a larger area of the door, which prevented issues that arose with splitting the wood along the grain when fasteners were clustered together. While no H hinges are currently present at the farm house, a third-floor west bedroom closet door shows the ghost of a previous H hinge on its interior (Figure 26). This ghost is situated under a layer of paint, indicating that this door was likely from the pre-Revolution period, but moved at some point to its current location utilizing a different style of hinge.

[75] Donald Streeter, "Early American Wrought Iron Hardware: H and HL Hinges, together with mention of Dovetails and Cast Iron Butt Hinges", *Bulletin of the Association for Preservation Technology*, Vol. 5, No. 1 (1973): 22.

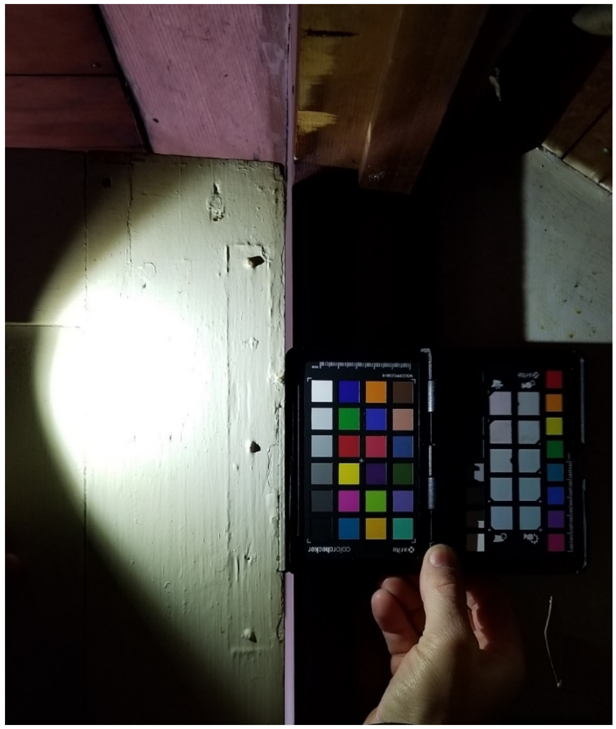

Figure 26. Ghost of a previous "H" hinge on a third floor door, indicating it was moved to its current location. Source: Author, February 19, 2018.

Though the ghosts of previous hinges may be apparent on the wooden members of some interior doors, all current hinges at the farm house are cast butt hinges. In a 1973 article on early American hardware, Donald Streeter states,

> "The cast butt was in its way, as important a development as the inventions of the cut nail machine cut screw, or the circular saw, in its effect on building construction. No longer need hinges be mounted on the surface with clinched nails…Invented in 1775, they are found on American buildings dating shortly after the Revolution, often in combination with wrought iron forms of hinges and other hardware."[76]

Mercer also echoes 1775 as an important date, after which butt hinges almost immediately supersede previous H hinges, therefore it is not surprising to find only butt hinges in the Raymond farm house. Aside from portions of the stone envelope and the timber lintel above the eastern fireplace, the earliest extant fabric appears to be from 1780, by which time this hinge

[76] Donald Streeter, "Early American Wrought Iron Hardware: H and HL Hinges, together with mention of Dovetails and Cast Iron Butt Hinges", 43.

was in popular use. Current studies have not determined details which might differentiate these hinges from more modern versions, therefore investigation of the screws holding these hinges in place is often more productive to inform chronology data.

3.1.3 Mouldings

While the dating of architectural mouldings is one of the more inexact forms of analysis due to its partial reliance on stylistic choices rather than technological ones, it is still a useful tool to help inform chronologies. Mouldings on door panels specifically are one of the features that Mercer discusses in “Dating Old Houses”, in which he stated:

1. Door mouldings prior to 1776 in this area were generally simple ovolo shape
2. After 1776 these ovolos changed somewhat abruptly to single or double quirked ovolo or ogee shapes
3. Doors panels were hand-made of one solid piece which were edge moulded (Figure 27) prior to 1835 and machine-made applied mouldings (Figure 28) were used after the general introduction of steam powered woodworking machinery circa 1835.

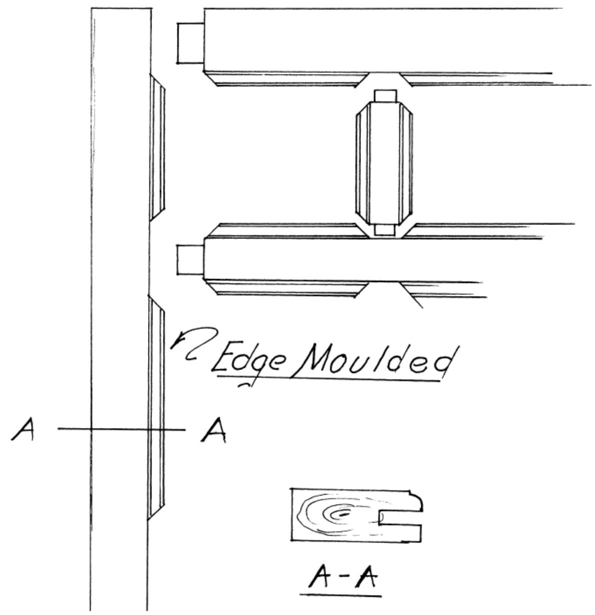

Figure 27. Example of edge moulding which run along the rails and stiles. Source: Henry C. Mercer and Dating by Mouldings by George McNulty, 1978.

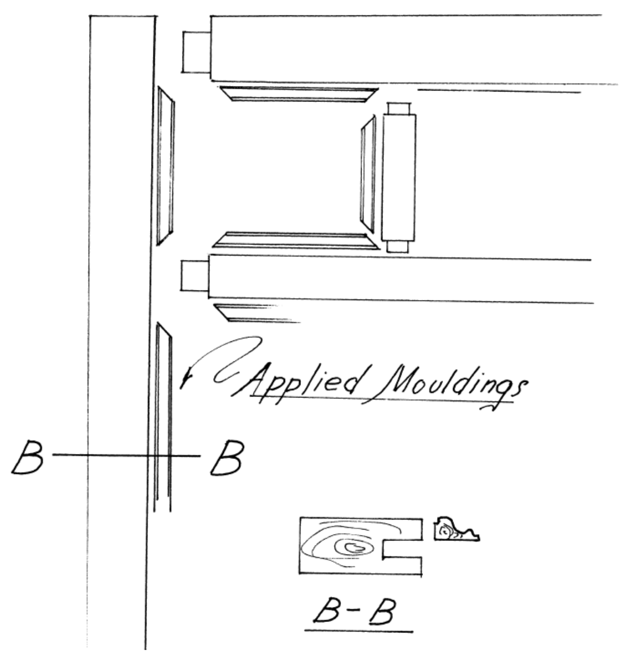

Figure 28. Example of applied mouldings nailed to the corners of the door panel. Source: Henry C. Mercer and Dating by Mouldings by George McNulty, 1978.

George McNulty counters in a 1978 article, stating that current research lifts a few of Mercer's restrictions. His conclusions also find that the solid panel style and simple ovolo shapes were preferred in early Colonial America, though he acknowledges that other styles were found as well, pushes the period of general use forward to 1800-1810. Conversely, he pushes the dates of origin for applied mouldings back to the 1800-1810 period, claiming that it was more cost efficient, and carpenters would adopt this style as soon as possible. Though Mercer again proves to be somewhat erroneous, the spacing of major building campaigns at the farm during 1780 to 1853 allows for both views to be applicable in determining which campaign wooden elements originate from.

Using this framework, analysis of the wooden doors in the farmhouse can inform their potential origin dates. The niche cupboard doors, the batten doors and the wooden partitions on the west end of the first floor, and the closet doors in the second-floor bedrooms are likely the sole remnants of the 1780 building campaign in their original placement. The niche cupboard doors are manufactured as a solid panel with edge moulding and sport primitive wooden handles. Though these doors do have an ogee shaped moulding, the edge-moulding construction coupled with a simple double beaded moulding on the surround indicates that it is likely part of this earlier campaign. Due to their prominent location in the main hall of the house, it is likely that the builders decided to utilize a more complex and upscale moulding for these features. Doors of irregular sizes such as these located on interiors tend to resist stylistic changes in later periods due to the difficulty in replacing them. Batten doors on the interior of a house were used mainly in the 1700s and fell out of fashion by the time that the mid-19th century campaign came about at this site. The closet doors on the second-floor bedrooms also show an edge moulded solid panel with a simple Roman ovolo on the doors themselves and an ogee on the stationary panels. Again, the edge moulded construction points towards a pre-1800 origin date, even though something other than a simple ovolo is used. Though many believe Quakers to eschew all ornamentation and frivolity, other accounts indicate that many attended social functions, entertained frequently, and decorated their homes with features in accordance with their own tastes.[77] The Ross family was moving up the social ladder around this time as mentioned previously, and Thomas Ross travelled frequently, therefore it stands to reason that they might have chosen stylistically more complex elements during the 1780 expansion.

Though the mouldings can indicate potential origin dates of the feature itself, there is always the possibility that they were removed from their original location and moved. This is the case with many of the doors in the house, and though moulding profiles indicate they were likely constructed pre-1800, other clues such as change in hardware, scarring, and modifications can indicate repurposing. This is the case for the doors that lead to the wood addition on the first and second floors, as well as the closet door in the west third floor bedroom, and the reasoning for determining them repurposed lies in the door typology in the appendix of this report. The stairs leading from the first to the second floor in the main room are also likely from the 1780 campaign based on the simple bead moulding on the fascia board covering the adjacent joists, simple yet elegant newel posts, as well as the unadorned and un-grooved balustrade, however the pre-Raymond floor plans of 1939 prove that it is no longer in its original position.

There are some moulding types that indicate definitively that they were made post 1810 as defined by McNulty, thereby falling into the 1850s Van Sant construction campaign. The three main doors on the first floor, two on the north façade and one on the south are built using applied mouldings in the form of elongated hexagons and rectangles (Figure 29). Also, the two panels stretch the majority of the length of the door without break by a horizontal rail, a style

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[77] Harold Donaldson Eberlein, *The Architecture of Colonial America*, (New York: Boston, Little, Brown and Company, 1915), 122.

that gained popularity during the Federal period of 1780-1850.[78] The windows are thought to be from this 1850s campaign as well, as during this Federal period several changes to window styles differentiate them from earlier Colonial styles. For instance, improvements in moulding profile milling allowed them to become thinner and more delicate, glazing bars are thinner with ovolo-shaped profiles, and glass panes are generally larger in normally 6 over 6 sashes.[79] The windows at the farm show all of these qualities, with the exception of the third-floor windows which are aren't sash style, however still display the thin ovolo moulding in the mullions.

Figure 29. Style of door used on the first-floor main openings on the north and south elevations. Distinctive elongated hexagonal moulding is applied to the panel with small finishing nails, inferring they were constructed in the early-mid 1800s. Source: Author.

<u>3.2 Environmental Monitoring:</u>

Many decay mechanisms are temperature and humidity dependent, therefore it is important to understand and monitor the interior environment of a structure to inform a

[78] Stephen Calloway, and Elizabeth Cromley, ed., The Elements of Style A Practical Encyclopedia of Interior Architectural Details from 1485 to the Present. (New York: Mitchell Beazley Publishers, 1991): 210.
[79] Ibid, 211.

conservation plan. Environmental monitoring data loggers were positioned on all three floors of the house, as well as one in the sub-grade basement in November of 2017 during the initial investigation in the course of the Wood Seminar. Though battery life and therefore applicable data varied between the data loggers, one thing is apparent: the relative humidity levels in all areas is quite high, staying above 50% for the majority of the currently recorded time period, even reaching almost 100% at one point on the second floor. Not only does a high relative humidity cause the moisture content of architectural elements to rise, but this in turn causes dimensional change in the form of swelling and shrinking. Continuous cycles of this effect can put stress onto the materials and may result in them never being fully dry. This high moisture content coupled with normal to high temperatures, particularly in wood, are the necessary and sufficient factors that allow rot to infest the historic fabric of the site.

These high percentages of relative humidity are likely indicative of water infiltration that then spreads through the entirety of the structure via air vapor. This environmental monitoring campaign should be continued beyond the extent of this thesis in order to screen the interior for potentially detrimental conditions. Extended monitoring will also test the efficacy of future treatments meant to halt the initial water infiltration through various points in the envelope. While this may vary depending on types of objects on display, collections care specialists generally recommend maintaining a relative humidity (%RH) range of 40-50% in order to prevent excessive swelling or shrinkage of collections. The Smithsonian's current recommended standards are 45%RH +/- 8%RH and 70°F +/-4°F, and this is also an acceptable range goal to set at the farm house.[80]

[80] Marion F. Mecklenburg, M. F., C. S. Tumosa and A. Pride, "Preserving Legacy Buildings," *ASHRAE Journal* 46(6): S18-S23.

3.3 Mortar Analysis

Considering the building's span of existence over approximately 275 years, it should not be surprising that there are several campaigns of mortar applied to the masonry envelope of the Raymond farmhouse. As the first goal of this thesis is to understand the material fabric, it is important to begin an examination of the characteristics of each type of mortar to both inform future decisions on repair and maintenance work as well as potentially identify situations which might be detrimental to the physical conservation of the site. The very first step in assessment is visual examination, in which differences of distinct mortar campaigns can be called out and patterns observed. In this instance, there have been at least four different types differentiated by visual inspection alone. These four campaigns have been outlined in detail in this section.

With so many different types of mortar patching and repointing, it is important to try and distinguish the historic from more modern types. During the visual assessment, it became obvious that there was one very distinctive campaign that contained relatively large lumps of pure white lime. These inclusions of lime are caused by incomplete firing of limestone in production kilns or by use of hot-lime mortars, in which quicklime and sand are slaked together in the same operation for immediate use. For both reasons, many historic hand-mixed mortars are inclusive of lime chunks and are helpful in identifying campaign chronology, as the advancement of lime burning techniques and advent of other binding agents relegate lime-chunk mortars to the early period of American history. Not only this, but also the placement of this type of mortar makes it likely that it is the original recipe from the initial construction period. For instance, it exists underneath more homogenous modern layers, and is found in both the door infill on the north façade as well as from the interior of the masonry wall, which was recently exposed after a screen door and its mooring timber member were torn from their intended location in a storm.

As it is believed that the infill on the north façade and the extension of the structure to the west occurred circa 1780, builders would have had no choice but to source lime from a local source. Conveniently, Bucks county held limestone deposits which were exploited for both building and fertilizing purposes from the very early history of settlement. From as early as 1703 when a tract of land was purchased for "the privilege to get limestone from the within granted premises."[81] This, and subsequent local kilns were located relatively near the farmhouse, "Another kiln was located a little over a mile east of the borough, and there were several in upper Buckingham and Solebury where the limestone had to be hauled for miles over hilly roads."[82] Though it seems counterintuitive to have kilns located away from the limestone sources, logistically it is more labor intensive to acquire the amount of wood necessary to have a kiln reach the temperature to allow the lime to calcine at approximately 1650° F and have a steady supply at which to keep it at those temperatures for at least several hours. The wooded area around Solebury and Buckingham supplied the large amount of wood fuel necessary, and isolated kilns such as one located in Aquetong village nearby supplied the local demand (Figure 30). Though the area capitalized on the natural limestone deposits in this manner, the industry decreased in the nineteenth century with the expanding use of cement for building and the advent of commercially manufactured fertilizers. Though no longer extant, it is highly likely that a local kiln supplied the necessary construction materials from limestone deposits in the area.

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[81] Warren S. Ely, "Lime Burning Industry, Its Rise and Decay in Bucks", in *A Collection of Papers Read Before the Bucks County Historical Society*, Vol. 4, read January 18, 1910, (Easton: The Chemical Publishing Company), 69.
[82] Ibid, 71.

Figure 30. Image of a lime kiln on the Aquetong Source: A Collection of Papers read before the Bucks County Historical Society, Volume 4, Photo by John A. Anderson, 1909.

Armed with the inference of at least one mortar campaign's chronology, data gathered by analytical techniques can be used to offer information that might be used in future conservation. There is a slew of methods to analyze historic mortar which vary in effort and complexity depending on the objectives for each project, including X-ray diffraction, SEM/EDS, petrographic and chemical analysis. Because this building has not yet been examined by a conservator or architectural historian, the most basic of the analysis techniques is the suggested starting point, which in this case is a type of chemical analysis known as Gravimetric analysis. This process, also known as acid digestion, involves initial visual notation of the mortar hand sample, crushing it down to a powder, then reacting the sample with a diluted hydrochloric acid which removes the basic calcium-based binder, leaving the aggregate behind. This analytical technique serves two purposes: the first is providing the proportion by weight of acid-insoluble material to binder, and secondly providing a sample of the original silica sand that can be examined for color and shape characteristics unhindered by the binding material. This examination allows conservators to find color matches of local sand to guide future sourcing options for repair work, as well as to potentially determine provenance of the sand by mineralogy. The current scope of this project is merely the beginnings of investigation and will include binder to insoluble aggregate ratio as well as sand color identification. Future work in this area might include creation and petrographic analysis of thin sections, as well as identification of specific binder types. Unfortunately, the results of this type of analysis proved to be unfit to analyze the mortar here because it appears that a limestone-based local sand was used, which was dissolved in the acid-base reaction. This resulted in a skewed aggregate to binder ratio, often closer to 1:1 rather than the normal 3:1 seen in most lime-based mortars. Further analysis using a different method will be necessary to find the true ratio and makeup of both the aggregate and binder of the different campaigns.

3.4 Infrared Thermography:

Archival research shows that water staining appeared on the cedar boards as early as 1940 (Figure 31). The stain in this photo is placed on the second-floor ceiling, generally underneath the bathroom on the third floor, indicating it is a plumbing issue rather than an exterior factor. While this is helpful in understanding the history of the site, it makes it difficult to determine which water stains in the house are historic and inactive, and therefore no longer an issue, or if they are active and need to be addressed in the overall conservation plan. There are a few options to investigate this research question: visual assessment during large-scale rain events, monitoring with a moisture meter, or use of infrared thermography. Because the stone envelope of the farm house is largely unoccupied with the exception of sporadic tours and programming, there is often no one present to witness active leaking during rain events. Scheduling prevented the author from visiting the farm house during a rain event, and the nearest one had been two days prior to a visit in early February.

Figure 31. Photograph of a water stain on the cedar interior, indicated by a green arrow. Source: Raymond Collection, University of Pennsylvania Architectural Archives, indicator arrow added by author.

Investigation with a non-invasive induction humidometer, which can measure moisture content by placing it on a wood surface with regard to its density, was used to determine if areas of staining had a similar or different moisture content compared to an unstained interior board acting as a control. While this did give inclinations towards stains that might be active, the highest recorded different in moisture content between the stained areas and the control was 4%. This information was noted and directed the subsequent investigation, however it was not used as hard evidence of water infiltration due to potential inaccuracies based in the means of measurement. These instruments have a larger margin of error than those that have pins which are inserted into the wood being tested, however invasive investigation was largely unused in the course of this thesis in order to preserve the historic fabric.

With visual assessment and moisture monitoring as mostly unavailable methods of investigation, passive infrared thermography was conducted from both the interior and exterior to attempt to determine areas of moisture infiltration and active water staining, as well as to inform analysis of energy efficiency. This investigation was conducted two days after a rain event, and due to the February weather, had remained cold and generally overcast up until the day of the author's visit. Conditions that day ranged from a high of 38°F in the afternoon to a low of 23°F at night, with overcast skies. While infrared thermography can be a useful tool to investigate the presence of moisture in building materials, it is important to realize the inherent inaccuracies and inexactness of the scientific procedure. It was not created for the purpose being applied in this situation, merely adapted to it by analyzing the data with regard to the environmental context it was applied in. Water bound in the pores of building materials such as wood, plaster and concrete will appear differently than surrounding "dry" areas due to water acting as a thermal conductor and bridge between areas of varying temperatures and relative humidity. This appearance will change based on the supporting environmental factors. For instance, when viewed from the interior on a day where the interior is warmer than the exterior, water will appear as "warmer" as it is transmitting thermal energy from the interior to the exterior and takes longer to lose its heat due to water's inherent thermally conductive properties. This is due to the second law of thermodynamics, which states that energy will move from an area of high energy to low energy in an attempt to reach equilibrium.

The results of the interior investigation showed areas of higher thermal activity compared to surrounding materials, while other appeared slightly cooler. The areas of higher thermal activity generally corresponded with the location of staining and can provide insight towards identifying areas of active water infiltration. After analyzing the images and investigated the interior of the attic, it has become apparent that not only might there be areas of water infiltration, but heat energy is leaking into the attic spaces and from there to the outside atmosphere. The attic is comprised of a series of trusses, the cedar boards that make up the interior are nailed to the joist undersides, and insulation has been blown on the top side of these boards and joists. The air temperature in this space in the afternoon of April 10th, 2018 was recorded as being 94°F and the underside of one of the roofing deck boards was recorded to be 81°F. It appears that heated air is leaking into the space and becoming trapped there in the small space between the insulation and roofing deck. The infrared images recorded on the third-floor interior showed heated air leaking from the attic space into the third-floor bedrooms, mostly through areas that show water staining. This is likely due to deformation of the wood members (i.e. cupping) which creates a larger opening through which both heat and liquid water can infiltrate from the attic space to the third-floor rooms.

4. Condition Assessment

4.1 Introduction

Conducting a condition assessment of a structure is done to gather data to diagnose the building's symptoms with the goal of determining the cause or origin of these observed phenomena. This information is then analyzed and compiled into a succinct report in order to inform both specialized and holistic approaches to future conservation. Often, this overall investigation results in the prioritization of projects dependent upon the severity of observed condition or potential for future deterioration of building materials. This documentation, used in tandem with other sources of information such as archival research and intended future use allows site stewards to enrich their understanding of the built environment, answer specific research questions, and inform a sitewide master plan. In the context of this thesis, it is important to recognize that there are certain limitations to the condition assessment. For instance, certain aspects of the building are not accessible to the documenting party, such exterior sub-grade envelope conditions, structural analysis is not included in the scope of work, and the intricacies of certain mechanical, electrical, and plumbing systems are also not included.

This condition assessment was conducted over the course of multiple visits to the site between October 2017-April 2018 and included both visual assessment and physical investigation of the structure and immediate vicinity. The assessment was constrained to the stone envelope due to the limited accessibility into the eastern addition, which is currently privately rented. Interior environmental monitoring ran from November 2017 to March 2018 by installation of HOBO data loggers that recorded temperature and relative humidity on all three floors and the subgrade basement. The site's dimensions were recorded, and architectural drawings were generated in AutoCAD 2017 software, which were then used as the base for the condition survey and aided in the orthorectification and montaging of photographs. Conditions were recorded by hand in the field, and then overlaid on the base drawings, and the range of interior conditions were compiled and included as a glossary in Appendix B In this report, conditions are identified and explained based on location in the envelope or interior. Based on these findings, a list of prioritized recommendations for material conservation was produced with the intent of informing the site stewards' future proceedings.

4.2 Environmental Context:

When conducting investigation, many aspects of the building's context are observed and recorded in order to examine the entire scope of variables that may influence the presence or severity of existing conditions. Beginning on the larger scale, yearly climate of the location is noted, as this is an important factor influencing the building's construction and use. Patterns of maintenance, heating, and ventilation as a result of climate should also be understood, as these are critical to the state of material fabric. Other enabling factors such as topography, flora, soil, and orientation are also important features to identify.

According to the climate zone maps, Bucks County falls in the 4A climate zone, meaning it is generally a warm and humid continental climate. Information gathered from 1981-2002 by the Northeast Region Climatic Center's Lambertville station, located just across the Delaware River from New Hope, shows extreme maximum and minimums for the area to range between 3°F and 101°F, with average maximums and minimums spanning 19.1°F and 75.7°F. Average annual precipitation is approximately 46 inches, with precipitation days comprising nearly 1/3 of the year. Prevailing winds come from the west and northwest.[83]

The orientation of the house is such that the two long elevations are nearly directly due north and south, therefore the south side endures more sunlight and evaporation, while the north remains shady, the lack of direct sunlight leading to longer evaporation times and higher water retention. While several large trees also contribute to shading the north elevation, the south has no obstructions to sunlight. Perched on the edge of a flat rise to the north, on the south side the land gently slopes downward towards two small ponds and a large grassy area with scattered trees. Ground water has been known to descend on the house from the north to proceed down the slope. Rain gutters drain from the east and west elevations, directing water to the sides.

Due to the circa 275-year lifespan of the house with its morphological changes noted in the building chronology section, it is impossible to accurately state the exact use of the site over

[83] Edward A. Tompkins. Soil Survey of Bucks and Philadelphia Counties, Pennsylvania (Washington, D.C:US Department of Agriculture,), 124-127

time, however it is quite likely that it has been utilized as a farm house for nearly its entire existence. Changes to landscape due to crop type or farming method cannot be determined, though this topic is potentially an area of future study. The eastern addition is currently in use as the domicile of the current woodworking artist-in-residence, however the rooms in the original stone envelope are unused except for sporadic tours and other programs facilitated by the site stewards. In this space, heat is kept at an average of 40°F during winter months and cooled only by natural means in the summer.

4.3 Conservation Values

Throughout the history of Preservation as a discipline, several charters have been drafted with the intent of defining principles and procedures necessary to the conservation of historic places. Like other philosophical arguments, changes in ideologies have resulted in a morphology of these principles and procedures in response to changing world views and beliefs. One of the most up-to-date and inclusive charters is the Burra Charter, which was based on and shared many principles with the Venice Charter, however moved past simply preserving the fabric of the built environment but also encompassing a complete understanding of a place's cultural heritage in order to inform decision making processes. As such, it is the belief of the author that this charter, updated in 2013, is the best able to represent the necessary principles of conservation of the Raymond Farm Center. This charter is intended for use by anyone involved in the care of important places such as property owners and managers, professionals including historians, engineers and archaeologists, and administrators in governmental positions relevant to the care of historic places. Inherent in this document are several overall principles:

- There are places worth keeping because they enrich our lives – by helping us understand the past; by contributing to the richness of the present environment; and because we expect them to be of value to future generations.

- The cultural significance of a place is embodied in its physical material (fabric), its setting and its contents; in its use; in the associated documents; and in its meaning to people through their use and associations with the place.
- The cultural significance of a place, and other issues affecting its future, are best understood by a methodical process of collecting and analyzing information before making decisions.
- Keeping accurate records about decisions and changes to the place helps in its care, management and interpretation[84]

Though these general principles are the guiding forces behind the procedures for preservation, the most specific advice relevant for this project is likely "The Burra Charter advocates a cautious approach to change: do as much as necessary to care for the place and to make it useable, but otherwise change it as little as possible so that its cultural significance is retained."[85] While the mission of the Raymond Farm Center is currently to provide an atmosphere of creativity in the spirit of Antonin and Noémi Raymond, conservation of the physical fabric of the site is not mentioned specifically. The goals of the site are to make it useable, however to non-preservation professionals this might include a huge intervention and integration of non-historic fabric. A complete conservation plan for this site should be defined by the principles included in this and other related conservation charters in order to retain the integrity of the site and therefore its ability to convey its cultural significance. This ideal of the Burra Charter acknowledges that interventions will likely need to be implemented in order to make the site useable to the site stewards and the general public but values the retention of as much physical fabric as possible. Major changes should be avoided, and any that are deemed necessary should be reversible if possible so that future generations might administer and enjoy it as is currently intended.

[84] M. Walker, *Understanding the Burra Charter*, Australia ICOMOS, 1996.
[85] "Why Conserve" in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Last revision in 1999), 1.

A seven-step process is advocated by this document and proceeds as follows:

1. Understand the Place
    a. Define the place and its extent
    b. Investigate the place: its history, use, associations, fabric
2. Assess Cultural Significance
    a. Assess all values using relevant criteria
    b. Develop a statement of significance
3. Identify all Factors and Issues
    a. Identify obligations arising from significance
    b. Identify future needs, resources, opportunities, constraints and condition
4. Develop Policy
5. Prepare a Management Plan
    a. Define priorities, resources, responsibilities, and timing
6. Implement the Management Plan
7. Monitor the Results and Review the Plan[86]

This work in this thesis attempts to complete the first step of understanding the place, as well as to begin the thought process on steps 2 and 3, though other in-depth works should be utilized to assist with these steps. Understanding the site specifically is a necessary and vital operation, section 26.1 states, "Work on a place should be preceded by studies to understand the place which should include analysis of physical, documentary, oral and other evidence, drawing on appropriate knowledge, skills and disciplines."[87] Development of policies and a formal management plan should be undertaken by the site stewards and any relevant stakeholders so as to not neglect the significance of the site for any particular person or group. Other policies of conservation should also be taken into consideration for implementation in the site's master plan, for instance those found in the Madrid Charter which apply not only to the architectural fabric but also interiors, fittings, associated furniture, art works, use and context.

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[86] "The Burra Charter Process" in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Last revision in 1999), 10.

[87] Article 26.1 in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Last revision in 1999), 8.

4.4 Decay Mechanisms

4.4.1 Ultraviolet and visible light photodegradation

When Antonin and Noémi Raymond decided to remove a portion of the south façade and open their house to increased amounts of light, air and space, it is highly unlikely that they were thinking of the long-term lifespan of the materials on the interior. Suddenly, historic materials including the floor boards, mantels, and plaster were subjected to an exponentially higher amount of sunlight for prolonged periods of time. Also, the new cedar plank finishing on the exterior and interior and items brought by the Raymonds such as furniture, textiles and books began their now nearly eighty-year exposure to the same conditions. The first floor in particular, where the row of sliding glass doors on the south elevation extends for about 26’ 3” allows light to hit the floor boards from shortly after sunrise until dusk, and maximum recorded infiltration was about fourteen feet into the interior from the southern elevation. This prolonged exposure has already shown to have deleterious effects, particularly in the older woodworking elements such as window surrounds on the south elevation, where photodegradation and color change have become readily apparent (Figure 32).

Figure 32. Showing checking of the wood sill and loss of color due to UV light. Source: Author, April 10, 2018.

In order to understand the weathering processes of any material, including wood, the physical structure needs to be recognized. As the tree's cells are predominantly organized in order to transport liquids from the ground to the highest reaches, the overall structure can be equated to a series of thin tubes or straws that are cemented together at their boundaries. The combination of the small open area of the tubes and the natural forces of surface tension and pressure facilitate the movement of nutrient-laden liquids up the tubular cells known as xylem tracheids.[88] Looking even more microscopically, these long cells are made up of three components: cellulose and hemicellulose which make up the major portion of the cell walls, and lignin, which acts as a colorant and binder holding the other two components together.[89] These liquid transportation cells also change with the yearly growth of the tree, as water is abundant in the spring, the cells are grown with a larger diameter to accommodate the influx, while in the autumn as the tree goes semi-dormant for the winter the circumference of the growing cells shrink with the water shortage. The resulting physiological differences distinguish the larger cells grown in the spring as earlywood, and the smaller cells from the autumn as latewood. Due to the lessened open cell space in latewood, the wood appears fairly dense due to the higher proportion of cell walls, and this constitutes the yearly rings that can be seen in a trunk cross section. As the tree matures and begins to grow, only the cells in a band along the outer circumference of the trunk remain active, and the interior cells expire as they are no longer used for moisture transport, meaning the pith, or heartwood, becomes a storage space for extractives such as Plicatic acid, thujaplicins, and other compounds, which provide resistance to

[88] R. Sam Williams, "Weathering of Wood" in *Handbook of Wood Chemistry and Wood Composites*, ed. Roger M. Rowell (CRC Press LLC., 2005), 145.
[89] Ibid, 142.

color loss and decay, though the role of these compounds in this capacity are still being studied.[90]

Though weathering and color loss from exposure to light have long been accepted as realities based on cause-reaction observation, the actual microprocesses that are occurring are still being studied, and further research is necessary to try and clarify these phenomena. This field of study, though ambitious, faces several challenges, including difficulties arising by testing of several different species of wood, only a few of which overlap from study to study, making it harder to reach overarching conclusions. Despite these difficulties, studies of ultraviolet damage support many points of that are currently accepted as the basis to the field. Though ultraviolet radiation ranges from 10-400nm, wavelengths less that 295nm are absorbed by the Earth's ozone and do not reach the surface, therefore for the purposes of wood weathering, only wavelengths from 295-400 contribute to UV degradation.[91] The wavelengths have been broken down into further categories: UV-A is known as black light, or long-wave UV and falls within the range of 320-400nm, UV-B spans 280-320nm and is the highest energy wavelength to reach the earth's surface, thereby being the most dangerous, and UV-C, the wavelengths shorter than 280nm and do not breach the ozone. It is important to understand that there are two different processes occurring in UV-induced deterioration of wood, though they are interlinked: photooxidation and photodegradation, the first of which results in a breakdown of the physical state of polymers composing portions of the structure of wood, and the second affecting the lightfastness of pigments, creating a color change.

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[90] Paul I. Morris, and Rod Stirling, "Western red cedar extractives associated with durability in ground contact" Wood Science Technology, 46 (2012): 991.
[91] R. Sam Williams, "Weathering of Wood",157.

Photooxidation is currently explained as a chemical process in which the UV waves that reach the earth's surface carry enough energy to disassociate the chemical bonds of the lignin, which is the strongest absorber of UV radiation in the structure of wood.[92] The excitation energy through photons in light causes the lignin polymer to form free phenoxyl radicals, ions that have an unpaired valence electron, which are relatively unstable and seek to either lose the extra electron through heat transfer to return to an unexcited state or gain another to fill the shell through an atomic bond.[93] Generally, water and oxygen molecules pair with the available electrons in free radicals, and the addition of these molecules forms a hydroperoxide and eventually carbonyl containing chromophoric groups.[94] The final step of this photooxidation process comes in the form of a Norrish type I reaction, in which the carbonyls undergo a photochemical reaction, and carbon-carbon bonds adjacent to α-carbonyl groups are fractured and photo-disassociated.[95] The breaking of these carbon-carbon bonds essentially is the micromechanical cause of lignin decay due to catalyzation by photons emitted in the ultraviolet spectrum of light. Once disassociated, these degradation products are removed from the wood surface through the action of wind or rain, the presence of which exponentially increases the rate of weathering. Because lignin contains the chromophoric groups, those materials which impart color to the wood, its degradation and subsequent removal through hydraulic action exposes the cellulose and hemicellulose, resulting in an overall bleached white-gray appearance.

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[92] Laszlo Tolvaj, et. al, "Combined effects of UV light and elevated temperatures on wood discolouration", *Wood Science Technology* 49 (2015), 1226.
[93] Laszlo Tolvaj, O. Faix, "Artificial ageing of wood monitored by drift spectroscopy and cie L*a*b* color measurements. I. Effect of UV light." *Holzforschung* 49 (1995):397–404.
[94] Maria Cristina Tamar, et. al., "Comparative study of photodegradation of six wood species after short-time UV exposure", *Wood Science Technology* 50 (2016),136.
[95] R. Sam Williams, "Weathering of Wood", 155.

4.5 Findings:

4.5.1 Envelope Scope:

Conditions of the envelope were recorded over the course of several site visits through visual assessment, however it is important to note that the lack of access to upper floors via scaffold, lift, or ladder means that this assessment is limited to what can be investigated at the ground level or sub-grade in the basement.

4.5.2 Masonry:

The weathering of natural building stone such as the fieldstone envelope of the farm house is incited by several variables including natural defects in the stone, faulty craftsmanship, chemical deposition of atmospheric pollution, soluble salt infiltration, and temperature via the freeze/thaw cycle. In response to the decay mechanisms described above, overall, the masonry envelope has weathered minimally considering its long lifespan, and issues created by found conditions are currently nominal. The masonry is comprised of many types of locally sourced stone varying in size and color. In-depth identification of these stones is not included in the scope of this project; however some stones can be identified visually including granite, various sandstone, red slate or phyllite, Pennsylvania black limestone, with other potentials including basalt, diorite, argillite and siltstone. Many of these stones, such as granite, are quite hard and natural weathering occurs over extremely long periods of time and are therefore not a current concern. The exception to this statement relates to the red slate, which naturally weathers in sheets due to the microstructure of the clay particles. Areas where this stone is found to be delaminating should be monitored, however due to the thickness of the masonry walls, total deterioration of these stones will not result in penetrations, but rather decreased structural capacity, which can be fixed by inserting a replacement stone in kind with the types found elsewhere in the masonry. Some types of granite appear to have an orange staining, potentially related to its mineralogy, and only changes the stone's aesthetics. The only area where moderate to severe weathering is evident in the masonry are rare instances where it appears that a low-fired brick or terra cotta unit was incorporated, and these have weathered to the point where almost all material has been lost. Craftsmanship of masonry is outstanding, and there appear to be no issues related to construction currently. Located in a rural area, atmospheric pollution is not an issue at present, and there is no visible surface efflorescence due to absorption of solubilized salts via groundwater.

Sub-grade masonry conditions appear to be worse than the minimal conditions present above-grade. Viewed from the basement, areas at the interface of the first-floor joists and foundational wall appear to have some loss of mortar, particularly on the north side. This is likely due to consistent water infiltration from the ground to the north as it drains southward down the rise. Evidence of both liquid and vapor water infiltration is particularly evident at a point on the north sub-grade masonry where the stair enters the basement from the Raymond eastern addition. Here, the Raymonds had instituted more modern materials as they created this interior passage, and both brick and concrete masonry units are found. The in a few cases the brick has some dimensional loss due to the evaporation of this moisture, and the fire skin has been completely lost. Though caused by water infiltration, it is also indicative of another problem, the mortar being harder than the masonry units. Mortar acts as a sacrificial material, meant to slowly disaggregate with the evaporation processes of trapped water in the masonry. However, if the mortar is "harder" or less porous than the surrounding masonry units, the water will choose the path of least resistance and evaporate through the masonry units instead, in this case a softer brick. This loss of brick, as well as water staining and accounts by the residents of liquid water running down the wall, indicate that water is infiltrating the sub-grade masonry at a high rate, and the interior materials such as brick and mortar are being slowly eroded by the evaporation process. Though sub-grade excavation was not included in this project, this information likely indicates the lack of an exterior waterproofing membrane, which exist in modern buildings but are not included in historic structures where the technology was not readily available.

<u>4.5.3 Exterior wood:</u>

As exterior wood is exposed to several decay mechanism catalysts such as sunlight, wind, rain, and insects, several different conditions can arise, including biological colonization, UV degradation, high moisture content, insect infestation, rot, and subsequent soft wood and dimensional loss.

Ultraviolet degradation is prevalent throughout the exterior wood of the envelope. Described in-depth previously in this report, UV degradation occurs when UV light carries enough energy to break the chemical bonds between the lignin, cellulose and hemicellulose, which are the structural components of wood. This causes deterioration of the lignin in particular, which is eroded away through the action of wind and rain, leaving behind the white cellulose, giving the wood members and overall bone-gray driftwood type of appearance. Though found in all exterior wood locations, UV degradation is particularly severe on the unfinished cedar shiplap of the eastern addition's south elevation. Evidence of this is found in both the color of the shiplap boards as well as the surface loss of the earlywood, leaving raised bands of latewood (Figure 33). In some cases, the surface loss has been so severe that as the deterioration products are washed away, new surfaces are exposed to begin weathering. Both dirt and mold, a lower form of fungi, gather on the weathered surfaces, and though it looks aesthetically unclean, these products do contain melanin and act as a sort of protective barrier for the wood.

Figure 33. Raking view of decayed earlywood and therefore raised latewood in exterior cedar shiplap due to UV damage. Source: Author, March 27, 2018.

High moisture content is the enemy of all wood products, causing a series of problems including biological colonization, rot, insect infestation and finishes failure. Of the two major types of rot, brown rot, or is found generally throughout the window sills and surrounds, particularly the lower portion of the jambs, and is most prevalent in the wood member that comprises the southeast corner column of the eastern addition's porch. This brown rot, or *serpula sp.* is a type of fungal infestation which requires a high moisture content above 20-30% as well as a food source of wood to survive. The fungus attacks the cellulose portions of the wood's microstructure, leaving the brown colored lignin behind. Unfortunately, the cellulose is the main structural component, therefore its removal drastically decreases the wood member's mechanical properties and can cause entire systems to become structurally unsound. This condition can show itself in both its advanced form where it appears as a series of cubes in the wood structure, or in its nascent stages of simple “soft” wood that is able to be easily penetrated with an awl or other probing device.

Other types of attack come in the form of biological colonization, which for the purposes of this report is defined as a visible biological presence on the surface of a wood member, thereby not inclusive of rot, which can penetrate all depths of wood and is usually not a visible plant, but rather identified by its symptoms of brown color and softened wood due to degrading molecular bonds. The visible spectrum of biological colonization comes in the form of algae, appearing as a mossy green film, and lichens, which are complex organisms of various shapes and sizes. These organisms not only indicate the presence of moisture but will also act as a sponge holding moisture against the substrate, which slows evaporation, increases moisture content, and supports further biological growth. This condition is observed generally on wooden exterior elements, however is more severe on the north elevation of the eastern addition, where the combination of shade and higher moisture content create the ideal environment for biological colonization.

Other elements of the envelope, though made of modern materials, are in somewhat poor condition. The storm windows placed over the historic sash windows in the 1970s have weathered to the point where openings allow moisture and air to reach the interior windows, and these pockets of stagnant humid air not only increase moisture content, but also allow an environment for biological activity and finish failure. The metal seam roof protruding slightly over the southern terrace porch has experienced water-induced corrosion evidenced by rust corrosion products and staining.

4.5.4 Interior Scope:

The interior of the farm house was investigated with the exception of the eastern addition, which is currently a private residence of the artist-in-residence. Though in-depth investigation of this area was not conducted, visual observation notes the same conditions detailed in the other areas of the interior.

4.5.5 Basement:

Moisture infiltration through ground water appears to have caused issues in the sub-grade basement. One joist on the southwest side of the house shows extreme checkering, indication of a severe case of brown rot (Figure 34). While other joists do not display the same level of degradation as this one, other joists are also displaying early signs of rot, dimensional loss exposing softer, sponge-like wood tissue. As described previously, rot needs a high moisture content to survive and thrive. A high moisture content also is necessary for some types of insect infestation, and many joists in the basement show signs of powder post beetle holes. These insects need about 15% relative humidity to survive. Adult females deposit their eggs into the pores of a wood member and the larvae consume the starch, creating long meandering tunnels, then bore their way out leaving small circular exit holes. One indicator of an active infestation is the presence of frass, a powdery waste product, near their exit holes. No accumulations of frass were seen near the exit holes, however the general dust and debris in the area might obscure this waste product. Other indicators support the hypothesis that this is not an active infestation, for instance the exposed holes and surrounding wood do not appear to be fresh, and these areas have weathered in conjunction with other non-infested areas, leading the author to determine that it has been some time since the insects were present.

Figure 34. Basement joist showing classic checkerboard pattern indicative of a type of brown rot. Source: Author, March 27, 2018.

Also located in the basement, a concrete slab where the furnace is located has cracked and is deforming downward due to the weight of the equipment. Inspection of this slab shows that it is only about an inch thick, and that there is a small gap of about ¼ inch between the bottom of the slab and the dirt layer below it. An architectural drawing showing the pre-Raymond basement indicates that a water holding tank was located in this area prior to 1939. Inspection of the other concrete in the basement shows slightly different construction, and the slabs are much thicker. It is the current hypothesis that the area where the concrete is currently cracking was poured by the Raymonds onto flat earth, however mild erosion due to water movement from the north side of the building to the south coupled with the weight of the furnace have resulted in a lowered substrate and subsequent deformation of the concrete.

4.5.6 Above grade:

Above-grade, it appears that the conditions in the interior are mostly related to the interplay of water infiltration, temperature fluctuations, and UV light. As described in the chronology section, a type of rigid foam insulation was applied to several interior walls along the north and south facades in the 1970s in an attempt to keep interior conditions at a level within the range of human comfort. This insulation material appears to have a thin cement coating, creating a hard, uniform appearance when painted. This coating has developed microcracks, running generally throughout the panel, but particularly located at corners and other penetrations. This cracking was likely caused through shrinkage due to fluctuations in temperature, yet likely does not detract from the insulative qualities and is not an overtly visually intrusive condition.

Interior areas of high exposure to light, particularly the wood members that comprise the oldest window surrounds in the eastern portion of the stone envelope show symptoms of UV degradation, including color and surface loss. Apart from these standard UV degradation symptoms, the older surrounds also display iron staining around fasteners, and subsequent mild dimensional loss. This staining is common in historic woodwork, as wood is naturally slightly acidic. When combined with water in liquid or vapor form, naturally occurring acetic free radicals hydrolyze to create acetic acid, which reacts with ungalvanized fasteners to create this dark corrosion product (Figure 35). Floor boards closest to the swath of sliding glass doors on the first floor's south elevation show a higher degree of checking than interior boards protected from prolonged direct sunlight (Figure 36).

Figure 35. Floor board near the center of the panel of glass doors on the first floor shows increased rate of checking compared to other boards due to cyclic exposure to sunlight.

Figure 36. Black staining on a wood window surround due to untreated iron in wrought nails. Source: Author, March 27, 2018.

Finish failure is generally extant throughout the house, however areas that are only masonry and plaster with no rigid foam insulation layer show a higher degree of “alligatoring”, peeling, and loss of paint. Most noticeable is likely near the first-floor eastern fireplace, where a hot water pipe runs through the masonry. Infrared thermography showed that this area is much more thermally active due to the plumbing, and the increased temperature range means fluctuations between heating and cooling cause accelerated weathering of the paint layer. Overall, paint of the doors and window surrounds shows weathering and intermittent losses. Plaster covering masonry shows generalized cracking, particularly around corners of wall penetrations.

Relatively recently, storms have caused physical damage to the structure. Most recently, a screen door attached to the frame of the Quaker door on the south elevation was ripped from its mooring when wind forces caused the door surround wood to splinter and break. A small piece of the surround is still attached to the screen door frame, however it has exposed the masonry behind the surround. While this provided an interesting opportunity to view the interior construction of the wall, it also is now a large hole that can possibly allow for air and moisture travel, allowing water to infiltrate previously inaccessible areas and outside air to reach the interior. The door is currently propped closed, however the opening remains. The roof was damaged and replaced after the occurrence of Hurricane Sandy in 2012, the largest Atlantic hurricane recorded to date. Investigation into the attic crawlspace revealed that the ceiling boards of the 3rd floor are covered in insulation, and structural trusses span the attic just above this layer. It appears that roofers had replaced only the exterior envelope of the roof and neglected small gaps at the interface between the board floor and the roof slope (Figure 37). Though the roof decking appears to be relatively new, older boards also seem to be included in the construction based on their more weathered appearance. Nails have been driven through the roof decking, piercing any type of applied waterproofing membrane. Moisture can penetrate areas of incomplete seams around weathered boards and through miniscule openings surrounding nails, and if it follows the trajectory of the roof slope, it is bound to reach the openings along the interface. This weakness allows water to infiltrate not only the unused attic space, but also the third floor's interior woodwork at the confluence of masonry and wood members.

Figure 37. Image taken in the attic space showing holes between the roof decking and the cedar ceiling. Hole has presence of dirt and black staining on the wood, indicating the presence of water. Source: Author, April 10, 2018.

While the problem partially begins in the exterior envelope in the roof, water infiltration from both exterior sources as well as interior plumbing is the cause of many issues on the interior of the farm house. Most notable due to its visual impact, water staining on wooden elements, particularly on the cedar board ceiling of the third floor, appears in the form of black discoloration. These stains form as the result of either a severe singular instance or periodic wetting and are indicators of water infiltration through leaks in the envelope. Water staining on the lower floors is found in areas surrounding plumbing for upper floors, indicating that staining is also a product of faulty plumbing systems, whether past or existing. This dark staining is particularly visible in cedar, as the relatively higher amount of extractives in the wood react with iron and water to create a dark corrosion product. Cupping and other deformation of the cedar boards sometimes occurs in conjunction with this increased moisture content, often exacerbating the issue by creating a larger portal of access (Figure 38). The cedar boards to the east of the light well on the first floor have acquired an overall wave-like appearance, as previous plumbing issues caused slight warping and deformation of the boards.

Figure 38. Example of cupping cedar boards after water infiltration, creating a larger opening. Source: Author, January 26, 2018.

Because there are so many window penetrations in the building, particularly the south façade, maintenance of windows will generally help with the infiltration of outside air and moisture, the cause of many interior conservation issues. Currently the glazing on almost all windows is cracked and, in many instances, there have been areas of loss. Simply re-glazing the windows with a linseed oil-based putty is a good first step to protecting the interior spaces by creating a more leak-free environment. Linseed-based glazing putty is relatively inexpensive, and the process only requires a putty knife and the correct craftsperson. This is also a skill that can be learned within a relatively short period of time, though it does require practice to hone to mastery, yet the process is quite forgiving due to the fact that the putty can be removed and reapplied as necessary to achieve desired results. Therefore, this task has the opportunity to be turned into a conservation program available to the public, in which an experienced professional can guide attendees in the glazing process.

4.6 Recommendations:

This thesis intends to provide preliminary investigation into the conditions and relevant causes with general prioritized recommendations for treatment in both the long and short term. This information can then be utilized by the site stewards of the Raymond Farm Center for Living Arts and Design in order to develop an in-depth conservation plan for the building fabric in line with the Center's mission and current conservation values. In this respect, the recommendations below are given with the intention of stalling and perhaps preventing degradation and decay of the house's architectural materials while intervening as little as possible to maintain the historic integrity of the site. Mild conditions that are merely aesthetic such as scratching of floorboards and slight warping of interior cedar boards do not receive treatment recommendations, as these are not threatening to the materials themselves but rather provide a sense of age and use that enhance the Art Center's desired environment. These recommendations have also been issued with the knowledge that large-scale fundraising will need to be done in order to carry out many of these treatments. The following recommendations are in order of priority and are condensed into a succinct list later in the report.

4.6.1 Immediate (0-2 years):

Water infiltration and prolonged increased moisture content of air and materials is the cause of the majority of conditions present at the farm house and stopping this at the source should be the priority rather than simply treating the symptoms. Therefore, identification of specific entry points should be the first step in the plan's immediate phase. This means having a person actively assessing the behavior of materials in the areas of likely ingress detailed above during periods of heavy precipitation and ground saturation. This would require monitoring of both the north wall in the basement and points at the east and west elevations where the interface of 3rd floor ceiling and roof line meet. Monitoring these areas during periods of natural precipitation will inform site stewards which path the water might be accessing areas of the interior through the envelope. If this identification of active leaks reveals a small window of ingress, simple patching with flashing materials might prove to be the most effective treatment, both in cost as well as simplicity.

Because there are so many window penetrations in the building, particularly the south façade, maintenance of windows will generally help with the infiltration of outside air and moisture, the cause of many interior conservation issues. Currently the glazing on almost all windows is cracked and, in many instances, there have been areas of loss. Simply re-glazing the windows with a linseed oil-based putty is a good first step to protecting the interior spaces by creating a more leak-free environment. Linseed-based glazing putty is relatively inexpensive, and the process only requires a putty knife and the correct craftsperson. This is also a skill that can be learned within a relatively short period of time, though it does require practice to hone to mastery, yet the process is quite forgiving due to the fact that the putty can be removed and reapplied as necessary to achieve desired results. Therefore, this task has the opportunity to be turned into a conservation program available to the public, in which an experienced professional can guide attendees in the glazing process.

Projects that will require long-term testing can also be initiated during the immediate phase so that results will be ready to inform conservation work once funds have been raised. For instance, cleaning tests on both the weathered exterior cedar clapboards and stains of the interior cedar paneling should be conducted in order to identify the desired level of clean and to note any adverse reactions such as color staining, leaching, or material loss. While this color loss is less likely an issue on the exterior, choosing cleaning products for the interior is of utmost importance, as some chemicals might greatly discolor the red-brown hue of the wood and leave boards leached of color, creating aesthetic anomalies. Once the exterior cleaning tests have been completed, potential UV protective clear coatings should be applied to the clapboard in small test areas in order to monitor long-term weathering and performance. Interior environmental monitoring is also a useful tool that can inform the site stewards with regard to proper maintenance. This data will show whether temperature or relative humidity levels fall within museum standards, and appropriate measures can be taken in order to stabilize the interior environment. These tests and monitoring programs should be conducted over the course of at least one year, making them ideal candidates to begin right away so that the specifics of the project can be determined within the overall conservation plan.

One issue that has been noted during several site visits. has been that of outdated fire safety systems. Smoke detectors are in use in only a few areas of the structure, and fire extinguishers, while present in nearly every room, and in some instances need servicing or recharging. While a complete update of the fire system is recommended in the short term, efforts can be made currently to increase fire safety for both people and historic building fabric.

It is recommended that the extinguishers that need servicing be identified and replaced. Reaching out and arranging a guided visit of the site to the local fire department is a cost-effective way to ensure that they are aware of both the site's location and historic significance. If the department is made aware of these things, response time can be greatly increased in case of real emergency.

The southern screen door that ripped a piece of wood from the door surround is currently being propped closed with a board, however the piece needs to be reinstalled in order to seal the envelope more effectively. The displaced portion of the surround should be set back into place with a backing of a layer of mortar in order to reattach it to the stone wall, then the crack between the two wood members filed with a 2-part epoxy putty, which can then be in-painted to match the surrounding green paint, effectively hiding the damage and re-establishing some bonding to the stone wall substrate.

4.6.2 Short Term (2-10 years):

With investigation and longer-termed testing begun in the immediate phase, other conservation projects with high priority should begin to be tackled in the short term once funding is available. While these may be more in-depth treatments, they are often necessary to stall current deterioration processes. The most pressing issue is the water infiltration through the roof and sub-grade basement. While a patching program may be available to stop water coming through the roof in the immediate phase, the water entering the envelope through the ground and via runoff is harder to mitigate due to access issues. This bombardment of water is an enabling factor of the topography of the site and cannot be easily changed and therefore the entire northern side of the house will require more protective measures against water infiltration to prevent access to the interior spaces. This can be accomplished through several elements including a French draining system, and the application of a waterproofing membrane below grade. The French drain consists of a perforated pipe set into a trench filled with gravel that will gather water at the house's edges and redirect it away to appropriate drainage areas. This redirection will allow greatly reduced amounts of water to reach the building's foundation. While the necessary trench is being excavated, site stewards could potentially take this opportunity to apply a waterproofing membrane to the foundation via several plys of bituminous waterproofing sheets. While this treatment is not in keeping with the historic nature of the house, it will be hidden below-grade and therefore be invisible to visitors, as well as greatly increasing the protection from water and subsequent issues that arise from this infiltration.

Steps might also be taken at this point to re-secure the envelope below grade from the interior as well, with reapplication of mortar to areas that have experienced loss at the interface of the floorboards and masonry. According to current conservation values, replacements should be done in kind when selecting materials, however this poses a slight issue due to the number of pointing campaigns present on the façades above grade as described previously. Though these campaigns are various, due to previous maintenance work over the span of several centuries, it is known now that the original recipe included large chunks of lime and included a slightly red locally sourced sand. Because the basement was built in the mid to late 1700s, it is certain that this original mix was originally used here and is currently visible throughout. Because this is now known, conservators and site stewards can make the informed decision to repoint the losses in the basement with the recipe described earlier in this report. Not only is this replacing with a historically accurate recipe, lime mortars are also softer, which puts less stress on the historic masonry, and are easily reversible.

Once water infiltration issues are properly addressed, the next most pressing issue is UV degradation and color loss of the wooden elements, both interior and exterior. First and foremost, decisions will have to be made regarding the desired overall appearance of the exterior elements before proceeding to implementation of the UV coating. Namely, whether or not to stain the clapboards to attempt to return them to their original color before they had been bleached by the sun. In this case, it is important to try and construct treatments based on the architect's intent, and if it is thought that Antonin preferred the darker reddish color of the cedar clapboards, attempts should be made to return it to this state within the scope of the conservation plan. Though UV weathered boards do not absorb and retain paint well due to surface loss, they have been proven to retain stain color quite well.[96] Therefore, if the stewards decide to go this route, sample areas should be tested to determine desired color and proper application techniques. After tests of protective clear UV coatings have been completed in the immediate phase and decision-making regarding color is determined, the application should be applied as soon as possible to stall future degradation. Regardless of the decision, the exterior clapboards should be thoroughly cleaned, sanded, and prepped with staining if desired before application of the UV coating. It is also recommended that a Timbor Borate-based preservative be tested in conjunction with the stain and clear-coat. While testing will prove to be the ultimate deciding factor, it is recommended that the clear coating be a penetrating oil-based product rather than a film forming product. Application should take place when the moisture content of the wood is below 15%, the exterior temperature is between 50°F - 90°F, and rain is not in the forecast for at least 48 hours. Exterior wood cleaning tests should also be conducted using a quaternary ammonium cleaning product such as D2 and similar products.

[96] R. Sam Williams, "Weathering of Wood", 177.

While treatment of exterior wooden elements with a UV protective coating takes priority due to the more severe weathering present there, steps can be made during this short-term phase that are not quite as intensive that will greatly increase the UV protection of interior wooden elements. The most UV and visible light that can damage building materials enters the house through the row of sliding glass doors on the first floor, and these areas are in direct sunlight for the majority of the day. Ultraviolet light levels had been recorded in November 2017 using an ELSEC 765 environmental monitor, and the results showed that shoji screens effectively dropped the levels of UV that penetrated the interior to fall within museum standards, and therefore should be kept in place whenever possible to prevent UV absorption in interior materials. Unfortunately, the current sliding glass doors were installed in 1970, effectively obliterating the shoji door track built into the woodwork by the Raymonds during their original intervention. Shoji doors are currently simply propped against the glass doors, and often are not in place the entire length of the opening, which allows UV to enter the interior uninhibited. Reintroduction of a shoji track that would stabilize these shoji doors and allow them to easily be opened and closed at need would greatly reduce UV during periods when the site is unused. The family held papers include original details for windows and doors, which will allow a carpenter to recreate them in kind (Figure 39). Efforts should be made to employ a carpenter with Japanese woodworking experience in order to achieve the highest level of quality available and to promote the learning of Japanese crafts. This carpenter might also be able to perform other small repair tasks, such as crafting broken pieces to mend the wooden floor grates on the first floor. This relationship between the site stewards and the carpenter might be facilitated by an artist-in-residence program in which the carpenter would be offered short-term boarding in exchange for their services.

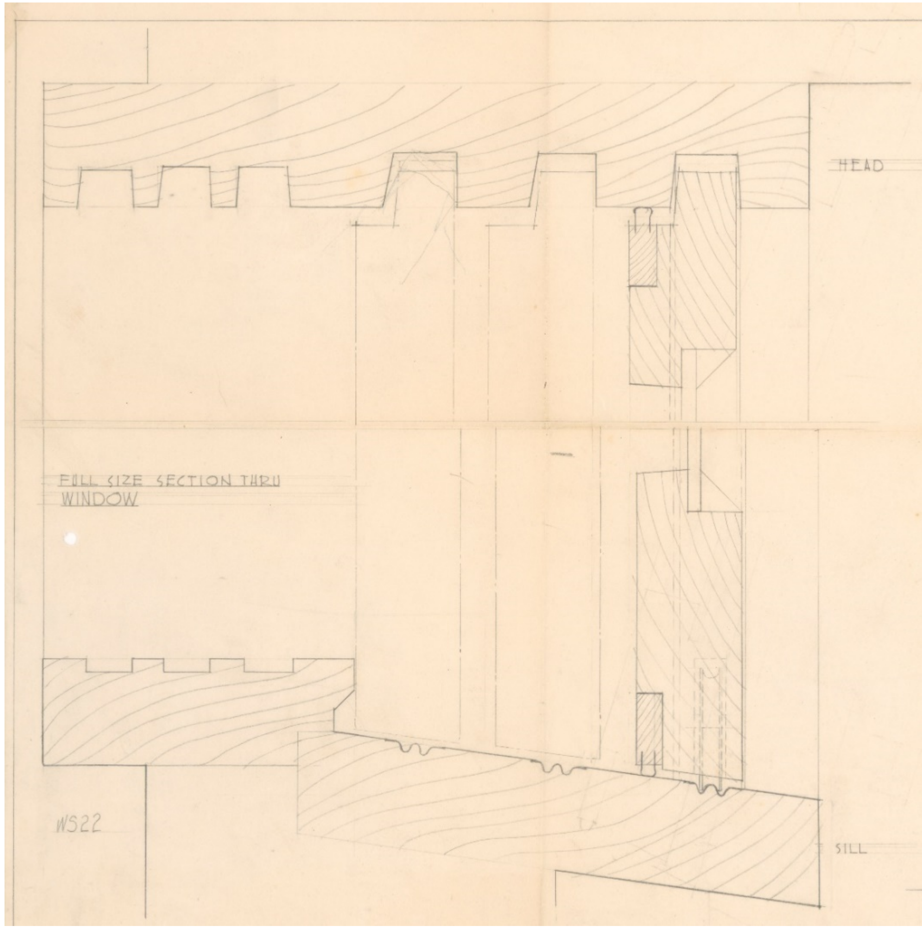

Figure 39. Section through window unit with patented rolling windows and shoji track. Source: Raymond family-held drawings.

Dark water staining on the interior cedar woodwork is evident in several places, particularly on the third floor. The dark color is often the combined condition of water and metals together, resulting in a dark corrosion product. These stains could be left as-is if desired by the site stewards, as they do not harm the wood and also impart age value to an extent, however cleaning these areas would also notify site stewards if a leak becomes active when a new stain would begin to appear. Testing to determine the best cleaning method and product can be determined in the immediate phase if desired, however due to the unharmful nature of the stains to the material fabric, implementation of a cleaning protocol has been pushed back to the short-term phase. Though cleaning testing should always be conducted, many instances of iron staining on wood are easily removed through the use of oxalic acid, which is available at many hardware and home improvement stores.

Though biological colonization on exterior wood elements is mostly aesthetically disruptive, it can lead to decay by increased retention of moisture, and in some cases, deterioration caused by chemical disintegration of the wood's cellular structure. While these decay mechanisms are quite slow, they still need to be addressed in the site's conservation plan, and treatments are relatively simple, with relatively inexpensive chemicals being used in most cases. Testing of the options for biocide might proceed as mentioned in the immediate phase, however implementation is likely to occur in the short-term phase in tandem with the UV coatings mentioned above, as the wood will need to be prepared for the coating. These areas of biological colonization can be applied with the chosen biocidal agent and cleaned over the entirety of the envelope within the course of a few days.

One of the Art Center's goals is to utilize the space as a studio for artists-in-residence, and in doing so will need to reassess the electrical, plumbing and mechanical systems to create livable spaces. Currently, historic light fixtures are not available to be used because they require a type of bulb system that no longer appears to be accessible. In some areas of the house, electrical outlets don't work and there are no working lighting fixtures. There are also plumbing "dead zones" in which the appliances no longer have access to the system. This will require specialized services from a firm specializing in historic fixtures and systems, in which they will need to do a full survey of the house and prepare plans to upgrade these systems to working features with minimal physical intervention or changes. This firm might be contracted during this phase, however work could potentially be implemented in the long-term due to the necessary planning.

4.6.3 Long term (10-30 years):

Though reintegration of the shoji door track in the short-term phase will assist in UV protection, measures to protect the interior while utilizing the space without shoji should also be pursued, as future programming might dictate the need for increased illumination via the glass doors and windows throughout the house. This can be accomplished through the use of UV protective films adhered to regular glass or clear acrylics installed in lieu of glass. Because some of the films have proven to be somewhat irreversible treatments that are difficult to remove, it is suggested that films not be applied directly to historic glass. Because the current sliding glass doors on the south elevation were installed in the 1970s and do not fall within the period of significance for the house, these can be coated as necessary without concern for reversibility, granting more flexibility with product choice. The historic sash windows, however, should have the historic glass be removed and stored, then re-glazed with pre-cut coated glass until such a time that other, more sensitive options can be explored.

Not only the sliding glass doors, but the current storm windows were also installed in the 1970s-80s, and not only detract from the aesthetic integrity of the house, but also are in a state of somewhat poor condition. Metal pieces have warped and created openings into the window pocket that are now havens for condensation and insect activity. While these coverings still create some level of protection against wind-blown objects, they are also in need of replacement, hopefully with a less visually intrusive iteration. Current research is investigating what alternatives currently exist that might blend more harmoniously with the other elements of the house and provide adequate durability.

Issue	Treatment Immediate Short-term Long-term	Priority
Water infiltration through ground	Monitoring French Drain Bituminous below grade waterproofing Repointing interior and exterior as necessary	High
Water infiltration through roof	Monitoring Patch with flashing Gutter maintenance	High
Exterior UV degradation	Cleaning tests Cleaning, sanding, staining (optional) Application of UV coating Annual maintenance	High
Interior UV degradation	Reinstatement of shoji door track Application of UV blocking filters or acrylics	Medium
Exterior rot	Dutchmen	Medium
Interior rot	Replacement	Medium
Fire safety	Update and refill extinguishers Contact local fire department Integration of fire suppression systems	Medium
Electrical, plumbing and mechanical systems	ID areas of work Hire firm Integration of upgraded systems	Medium
Storm windows	Replace	Medium
Window finishes and sealant	Re-glazing Paint stripping, sanding, reapplication of paint	Medium
Door surround storm damage	Reset wood against masonry Patch crack with 2-part wood putty epoxy Paint repair with matching color	Low
Cupping		Low
Iron staining	Cleaning with oxalic acid (optional)	Low
Biological colonization	Cleaning tests Removal with biocide	Low
Interior water staining	Cleaning tests Cleaning	Low

Several conditions aren't harmful to the site's material fabric, and also impart age value. These issues, while they can be addressed if the site stewards deem it a worthy pursuit, do not need to be treated at this time, and are called out in the list below.

- Interior paint finish failure
- Scratching and other indentations of floor boards
- Partially warped cedar ceiling boards, which create a slightly wave-like pattern
- Microcracking in exposed interior rigid insulation
- Deformation of thin concrete slab in the basement
- Inactive powder post beetle infestation holes

4.6.4 Future steps:

This thesis is merely the beginning of investigation and conservation of the Raymond Farm Center for Living Arts and Design and deals mostly with the material fabric of the structure, however due to the nascent nature of the non-profit organization that is administering programming at the site, many things need to be determined on the organizational level, and recommendations for future work are included here. Further physical investigation could result in the analysis of the binders of the different mortar types, and mortar mapping of the exterior might inform the chronology of these campaigns. Follow-up condition assessment after 5-10 years will notify site stewards of any relevant changes in the building's fabric. Long-term environmental monitoring over the course of one or more years will also inform the building's response to systematic changes that might accompany further sealing of the building envelope, such as raised temperature or lowered relative humidity. While this thesis only comments on the conservation of the building, furniture is also an important feature in creating the center's desired creative environment, therefore an inventory of furniture's origins, materials and condition would prove useful to crafting an in-depth conservation plan.

Other suggestions are more administrative-based, for instance it is recommended that when creating a site-wide master plan that a SWOT analysis assist stewards in their planning strategy. A SWOT analysis identifies and analyses a site's strengths, weaknesses, opportunities, and threats, and is a useful tool for overall site management. Funding is also an issue, and the young non-profit is attempting to build from the ground up. Funding sources such as grants and easements should be investigated, and the requisite qualifications addressed. For many grants involving historic structures, it is necessary to certify the structure as a historic site. This can be achieved best by writing a successful National Register for Historic Places nomination, which would include a historical background and description, both of which are incorporated into this thesis. This work would need to be tailored to the format of a NRHP nomination, however much of the information has already been gathered in the course of this report.

Finally, introduction of a Heritage Building Reinvestment Model will assist with planning and future funding allocation. This model identifies the components and systems of a historic building and estimates the remaining service life of these components as well as the current replacement value, meaning how much it would cost to replace the component at this point in time. When these estimates are complete, stewards can divide the current replacement value by the remaining service life for each component, and the resulting number is the required amount that should be set aside every year in order to replace that element when the service life of the component comes to an end. In this way, when maintenance work needs to be completed, funds are readily available from savings in previous years and work can go ahead unimpeded. It is important to stay abreast of these costs so that repair work can be completed in a timely manner and maintenance is not deferred. This deferred maintenance can create a backlog of issues that will add up to create a seemingly impossible list of issues that require addressing, putting pressure on the stewards and staff. If funding is appropriately raised every year to maintain the components and systems, a site is much more likely to utilize preventive conservation practices, addressing issues before they arise and become a larger problem than is necessary.

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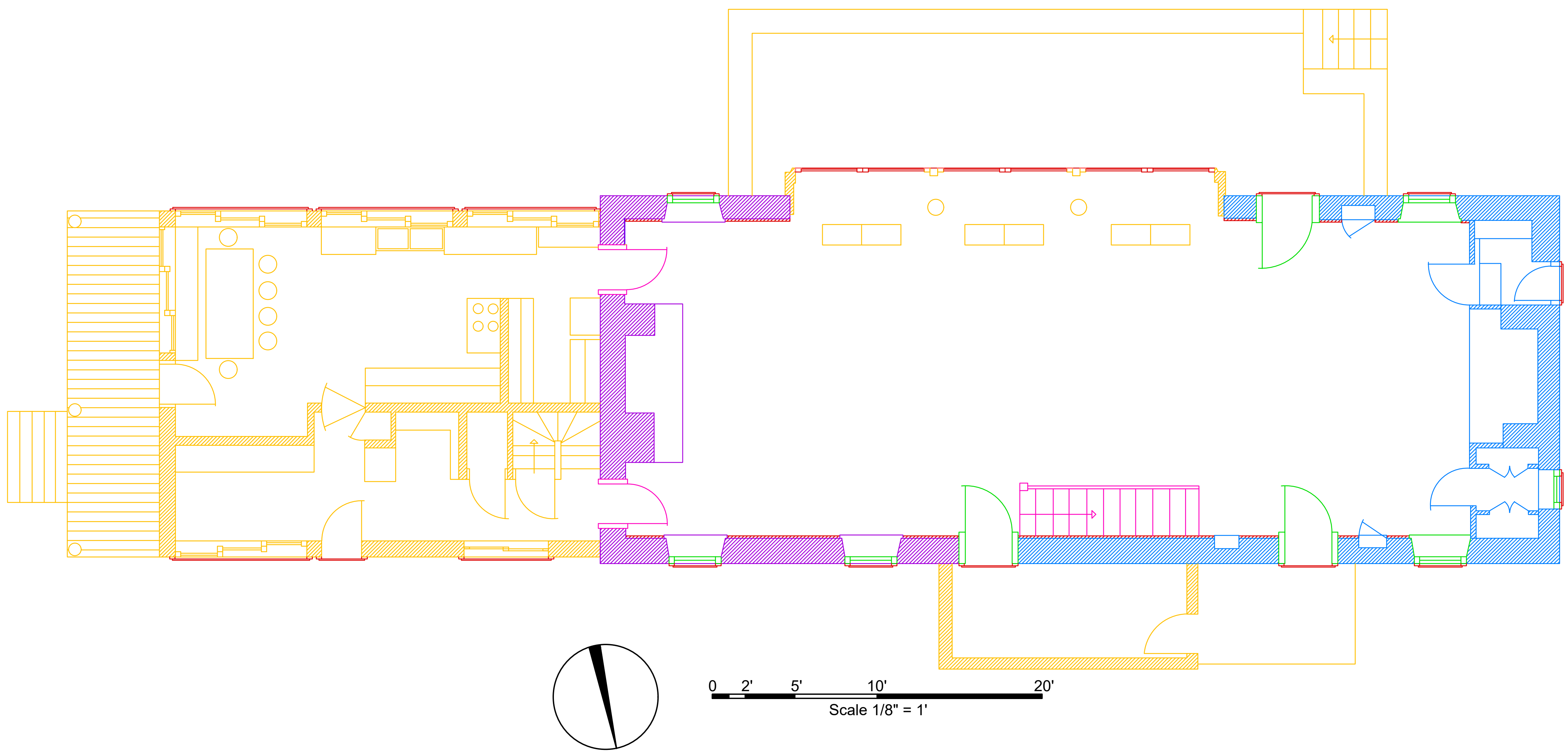
Appendix A: Building Chronology

Current Feature Floor Plans and Massing Morphology

Created by: Sara Gdula



Ross c. 1737-1743

Ross c. 1780

VanZant c. 1850s

Raymond 1938-1941

Quaker Fabric
Raymond Relocation 1938-1941

Modern 1970-Present

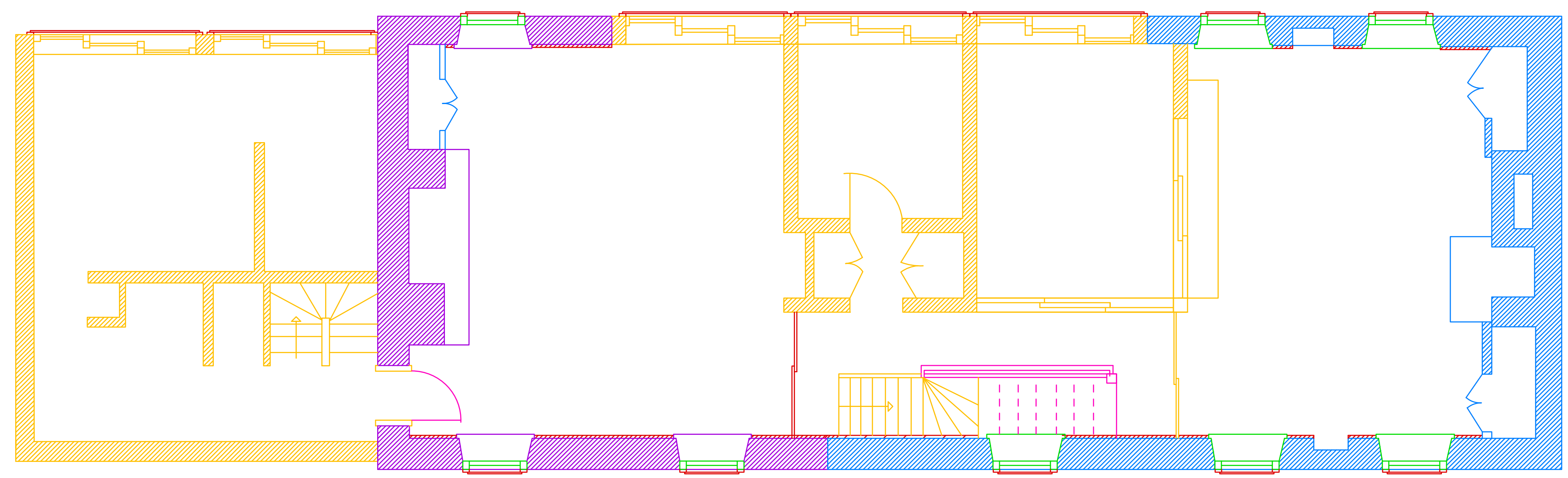
The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

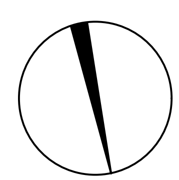
University of Pennsylvania
Graduate Program in Historic Preservation

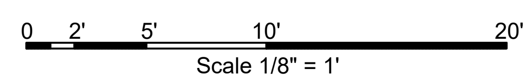
Building Chronology
Recorded and Prepared by
Sara Gdula

Farm House - First Floor
Current Features Floor Plan

Sheet #
5.2







Ross c. 1737-1743

Ross c. 1780

VanZant c. 1850s

Raymond 1938-1941

Quaker Fabric
Raymond Relocation 1938-1941

Modern 1970-Present

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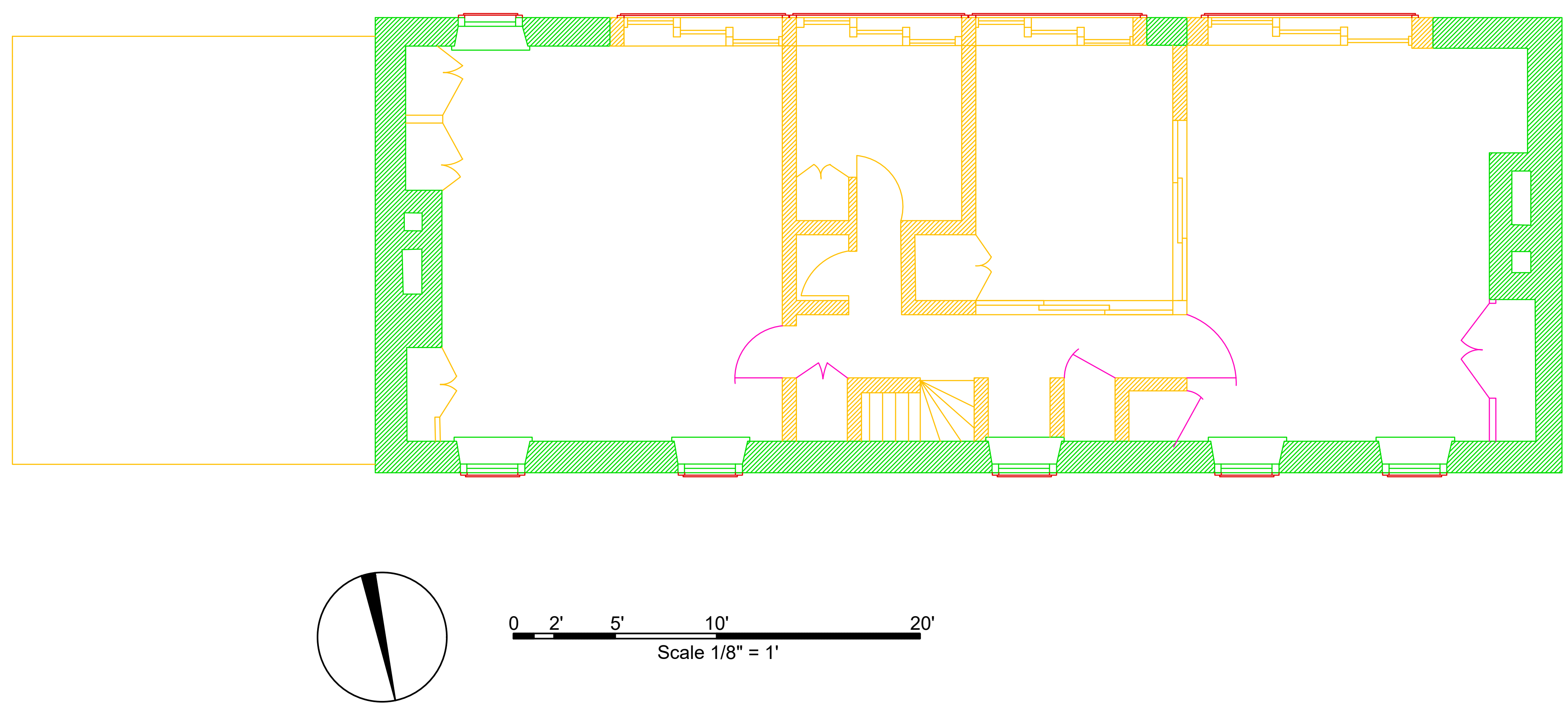
Farm House -
Second Floor
Current Features Floor Plan

Sheet #
5.3



Ross c. 1737-1743

Ross. c. 1780

VanZant c. 1850s

Raymond 1938-1941

Quaker Fabric
Raymond Relocation 1938-1941

Modern 1970-Present

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Farm House - Third Floor
Current Features Floor Plan

Sheet #
5.4

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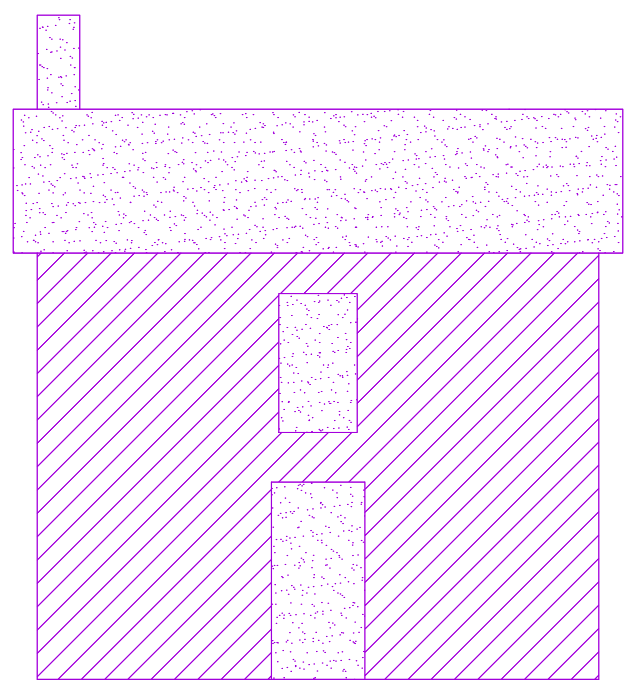

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Ross c. 1737-1743 | Ross c. 1780 | VanZant c. 1850s | Raymond 1938-1941 | Quaker Fabric Raymond Relocation 1938-1941 | Modern 1970-Present

Sheet # 5.5

Farm House - North Elevation Ross 1737-1743

Building Chronology
Recorded and Prepared by Sara Gdula

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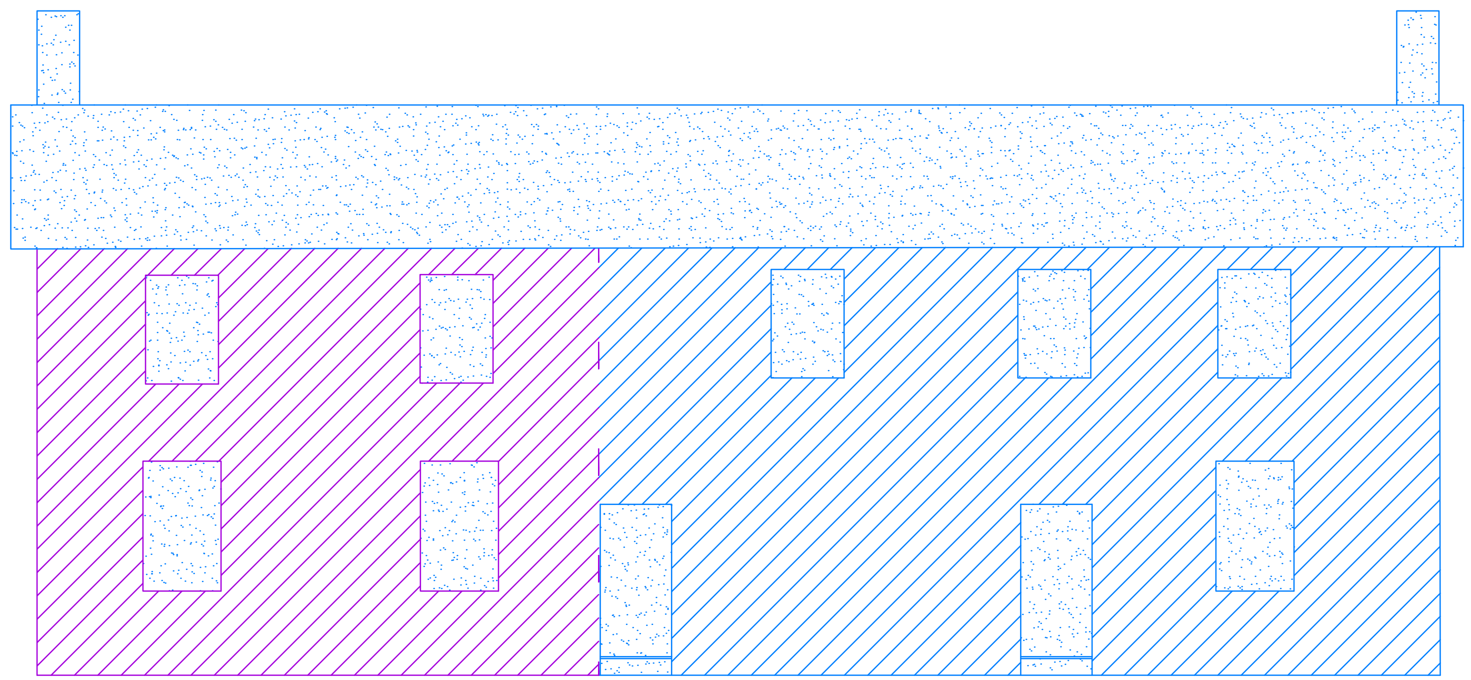
0 2' 5' 10' 20'

Scale 1/8" = 1'



Exact Style Unknown

Ross c. 1737-1743

Ross c. 1780

VanZant c. 1850s

Raymond 1938-1941

Quaker Fabric
Raymond Relocation 1938-1941

Modern 1970-Present

Sheet # 5.6

Farm House - North Elevation
Ross c. 1780

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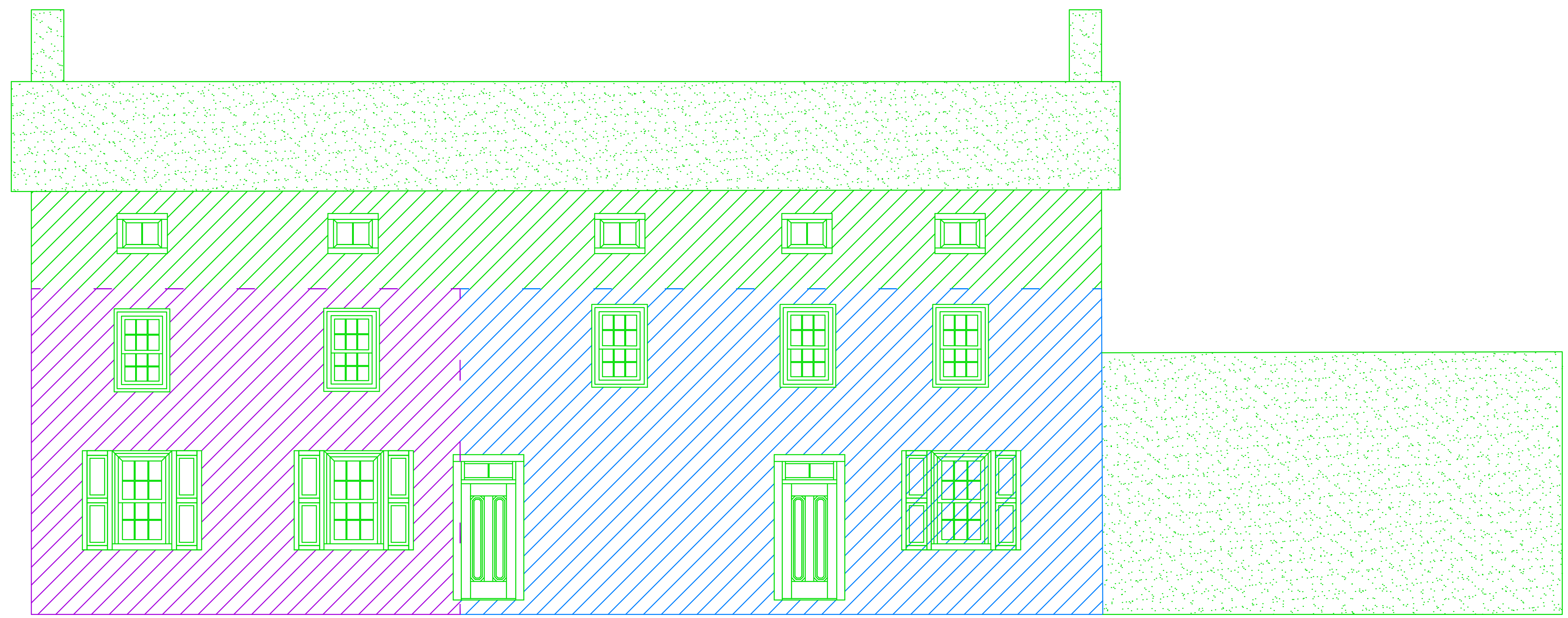
0 2' 5' 10' 20'

Scale 1/8" = 1'



Exact Style Unknown

Ross c. 1737-1743

Ross. c. 1780

VanZant c. 1850s

Raymond 1938-1941

Quaker Fabric
Raymond Relocation 1938-1941

Modern 1970-Present

Sheet #
5.7

Farm House - North Elevation
VanZant c. 1850s

The Raymond Farm Center for Living Arts and Design

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Building Chronology
Recorded and Prepared by
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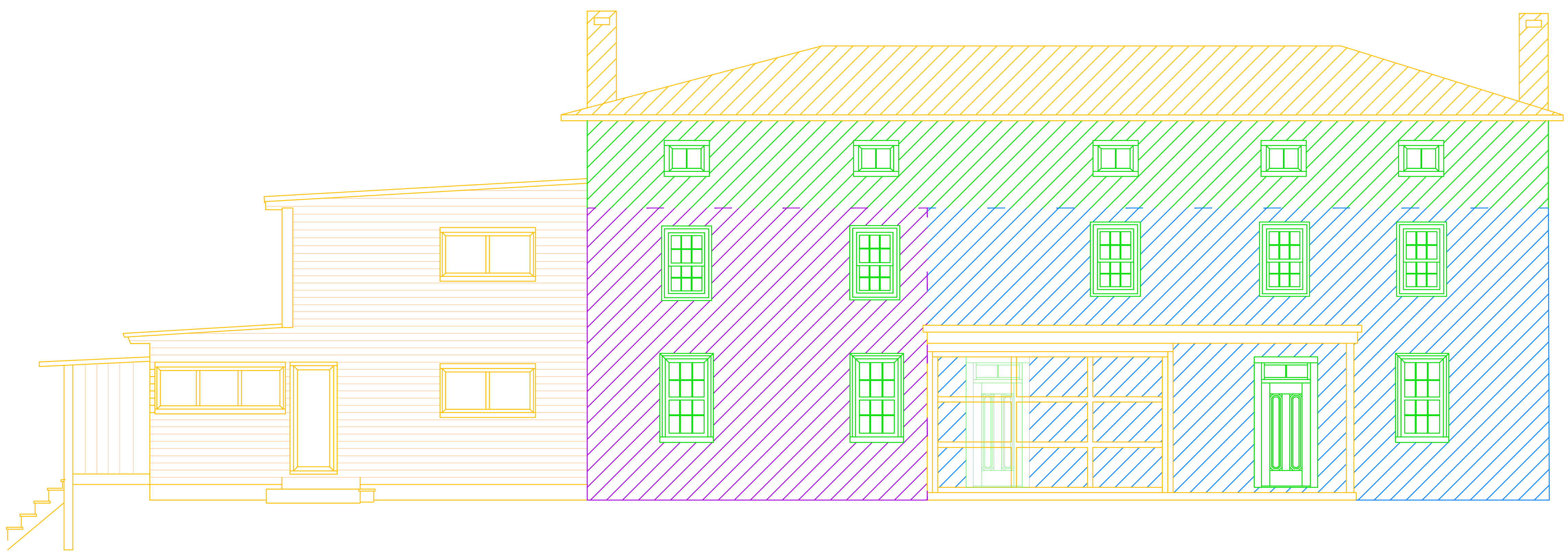
0 2' 5' 10' 20'

Scale 1/8" = 1'



Ross c. 1737-1743

Ross c. 1780

VanZant c. 1850s

Raymond 1938-1941

Quaker Fabric
Raymond Relocation 1938-1941

Modern 1970-Present

Sheet #
5.8

Farm House - North Elevation
Raymond 1938-1941

Building Chronology
Recorded and Prepared by
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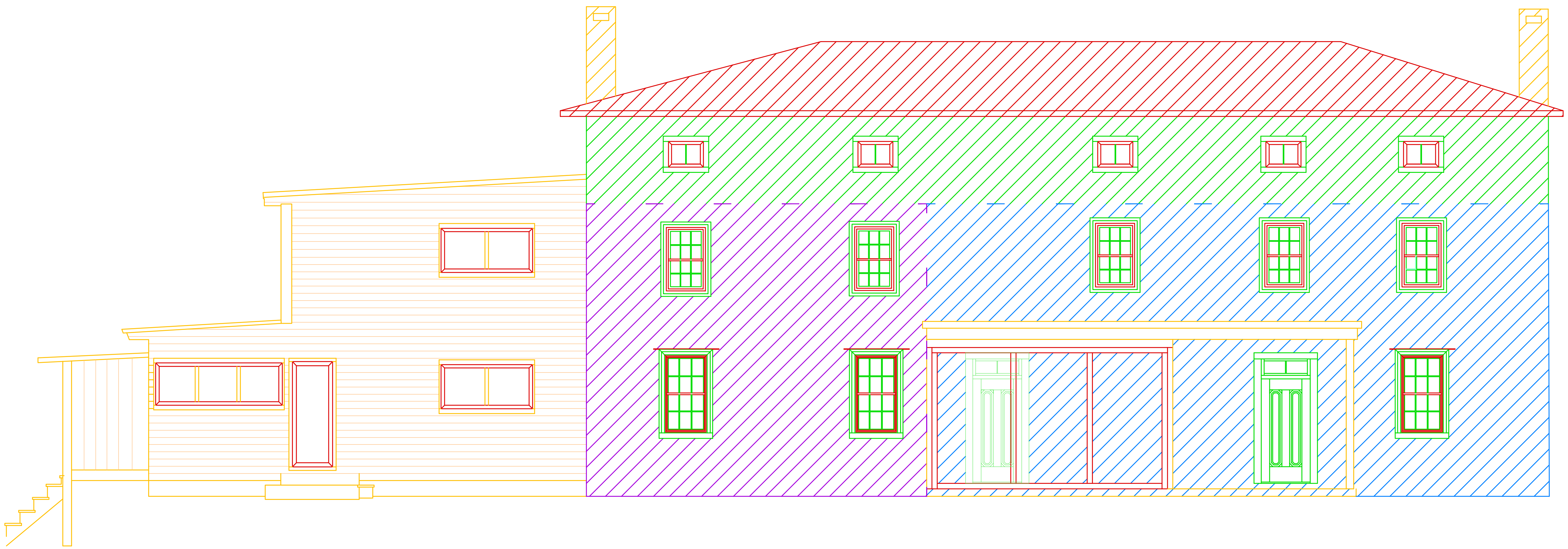
0 2' 5' 10' 20'
Scale 1/8" = 1'



Ross c. 1737-1743 | Ross c. 1780 | VanZant c. 1850s | Raymond 1938-1941 | Quaker Fabric Raymond Relocation 1938-1941 | Modern 1970-Present

Sheet # 5.9

The Raymond Farm Center for Living Arts and Design
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Farm House - North Elevation Current

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Appendix B: Interior Condition Assessment Drawings

Created by: Sara Gdula

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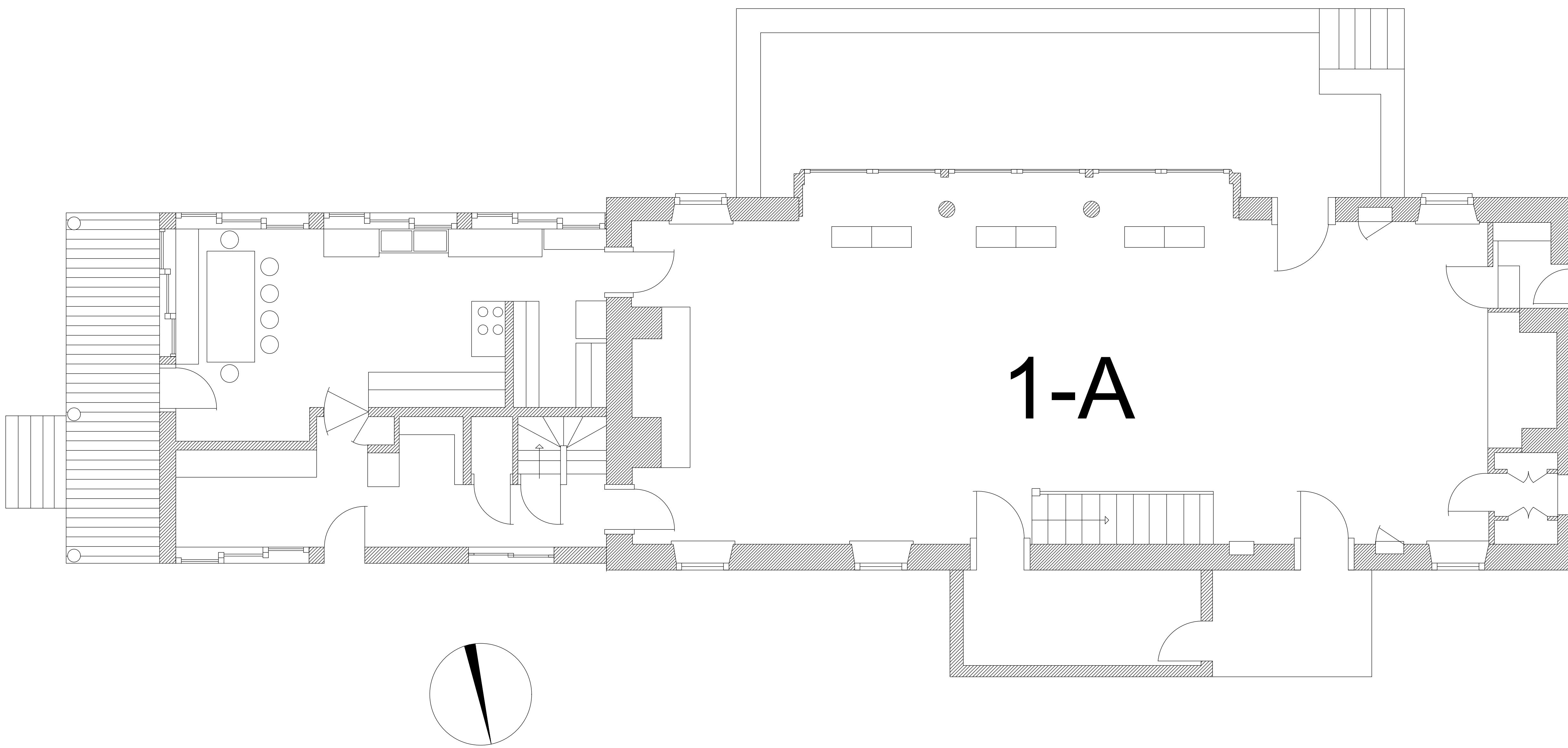
Scale 3/32" = 1'



Sheet #

1.1

Farm House - First Floor Plan

Condition Survey

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The Raymond Farm Center for Living Arts and Design

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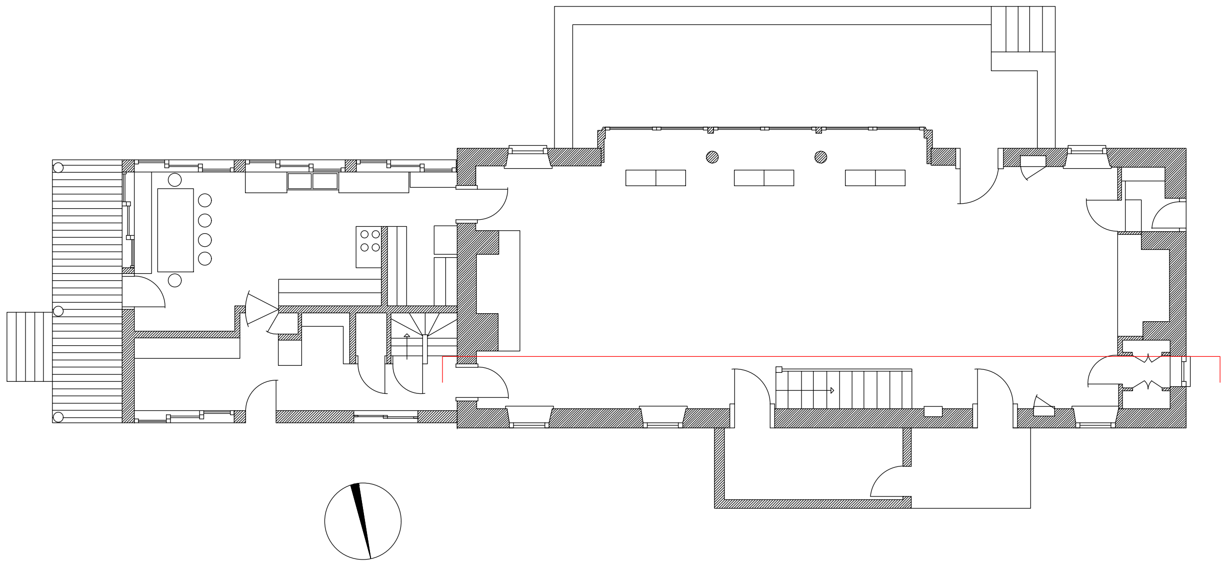

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Scale 1/4" = 1'

Finish Failure

Major Insulation Crack

Generalized Microcracking of Insulation

Sheet #
1.2

Farm House -
Room 1-A
North Interior Elevation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

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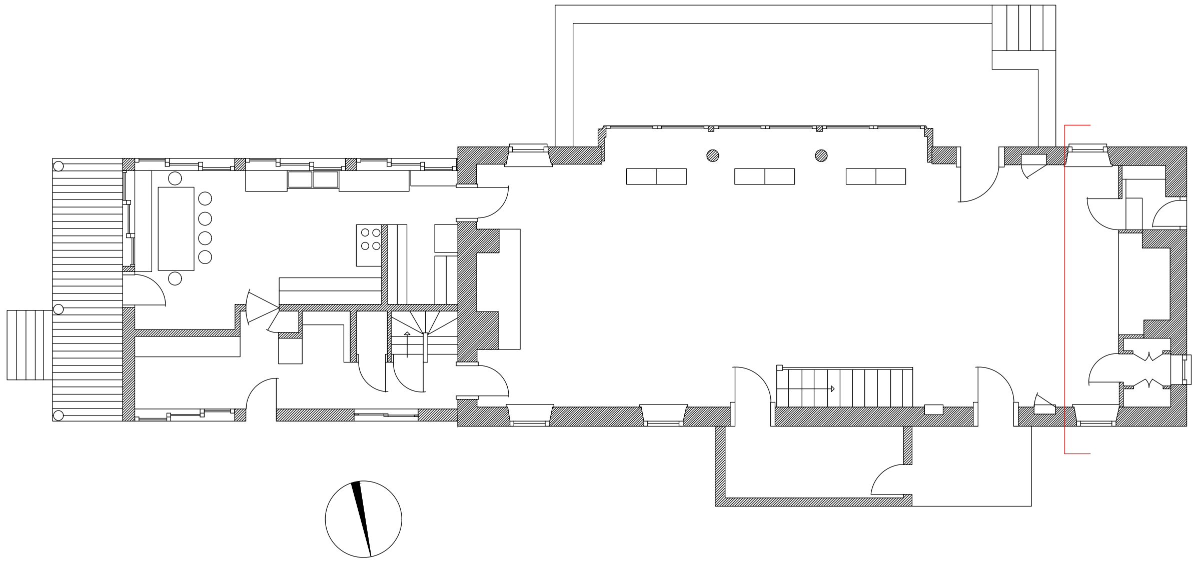

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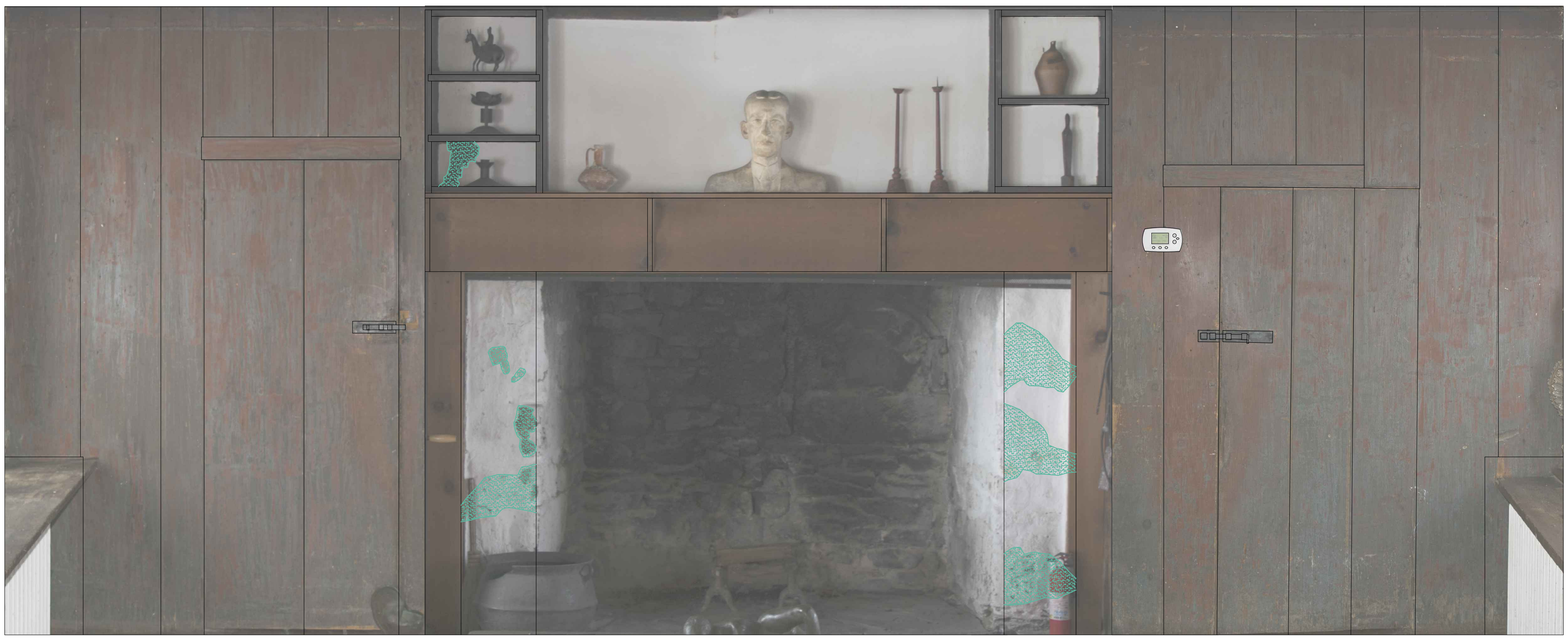

Sheet # 1.3

Farm House - Room 1-A West Interior Elevation

Condition Survey
Recorded and Prepared by Sara Gdula

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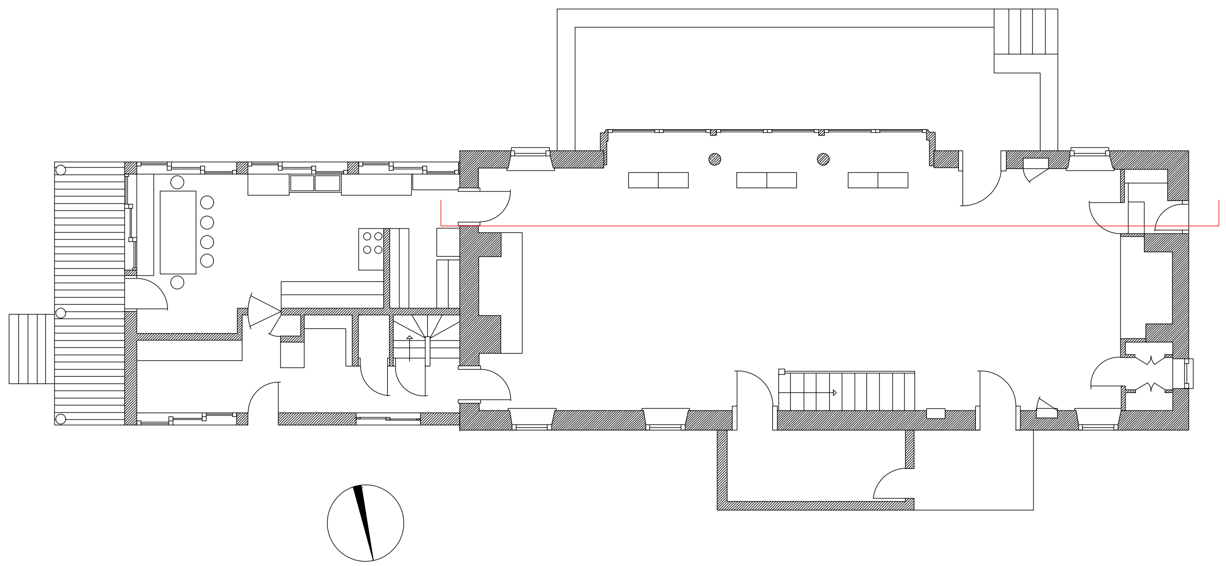

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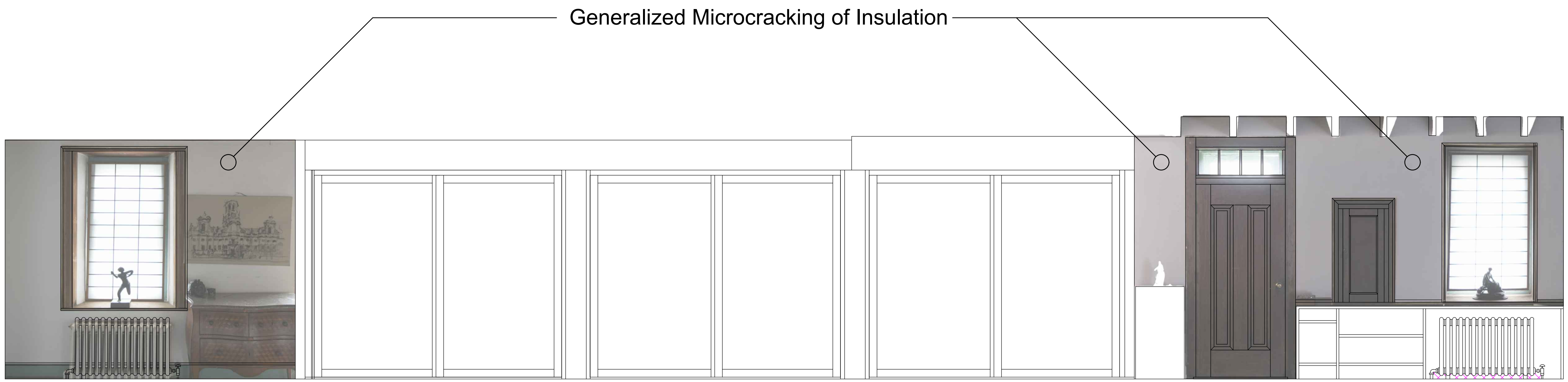

Sheet #
1.4

Farm House - Room 1-A
South Interior Elevation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey
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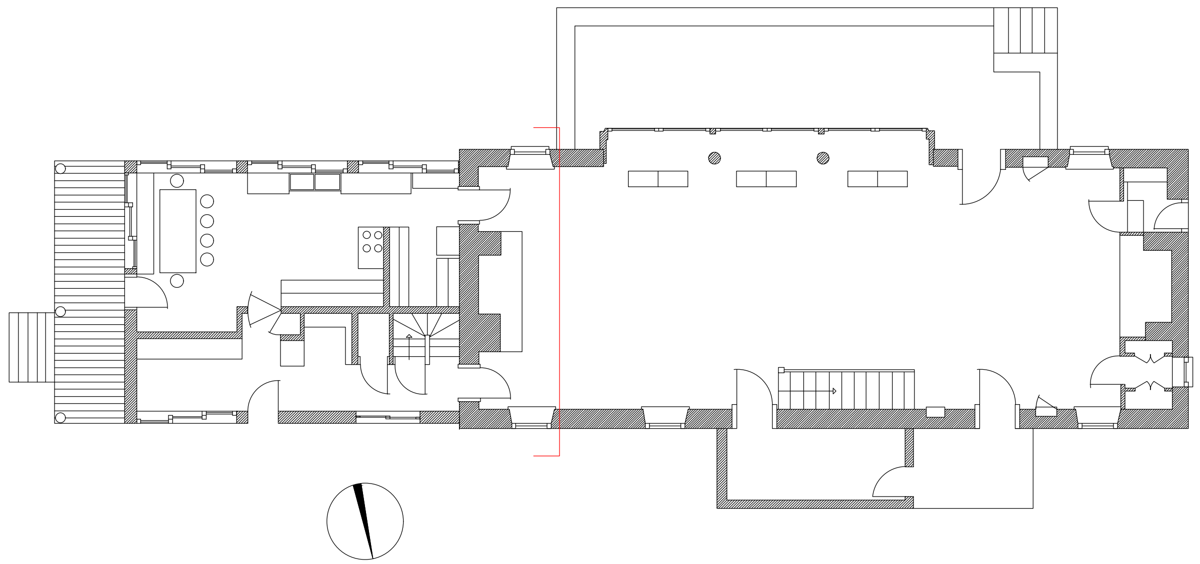

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Scale 5/8" = 1'

Finish Failure

Previous Repair

Plaster Crack

Wood Check or Split

Sheet # 1.5

Room 1-A
East Interior Elevation

Farm House -

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Recorded and Prepared by
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The Raymond Farm Center for Living Arts and Design
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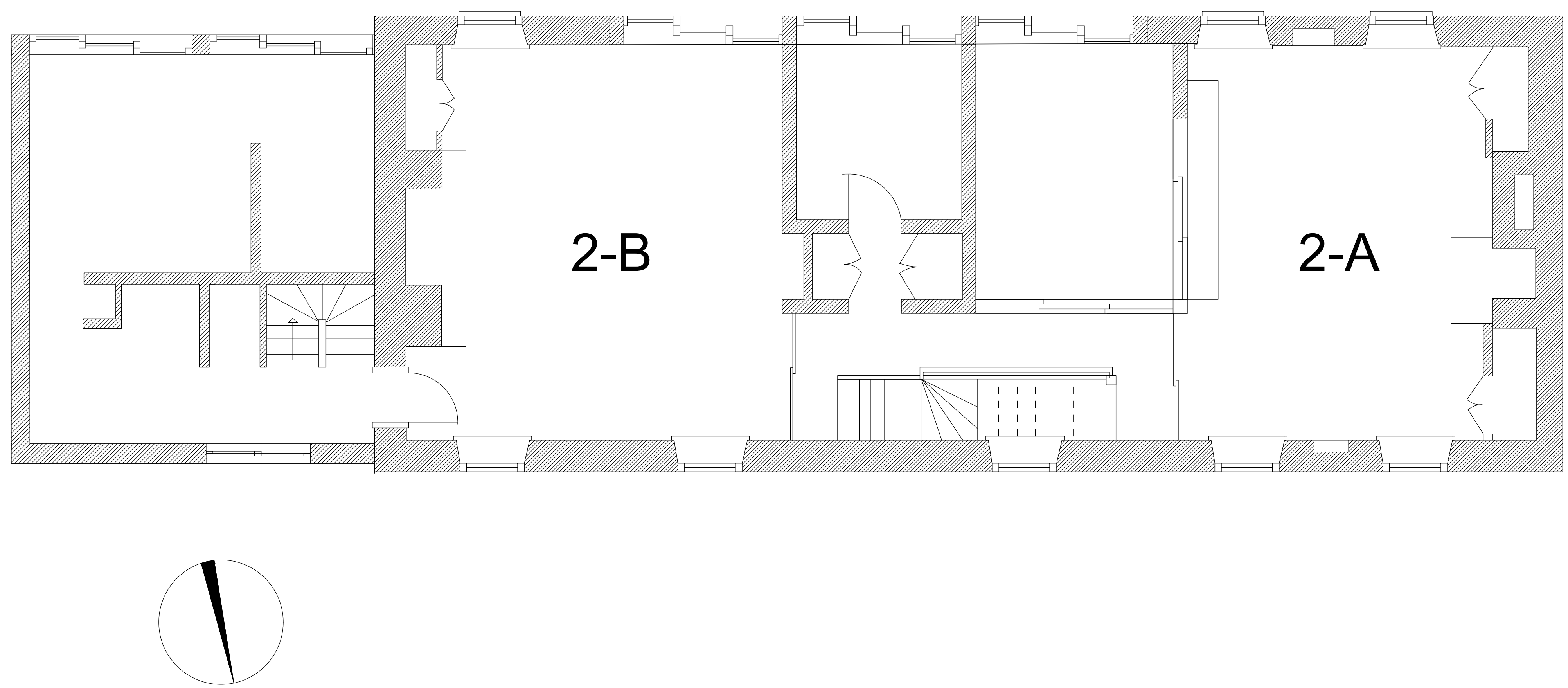
0 2' 5' 10' 20'

Scale 3/32" = 1'



Sheet # 2.1

Farm House - Second Floor Plan

The Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey

Recorded and Prepared by Sara Gdula

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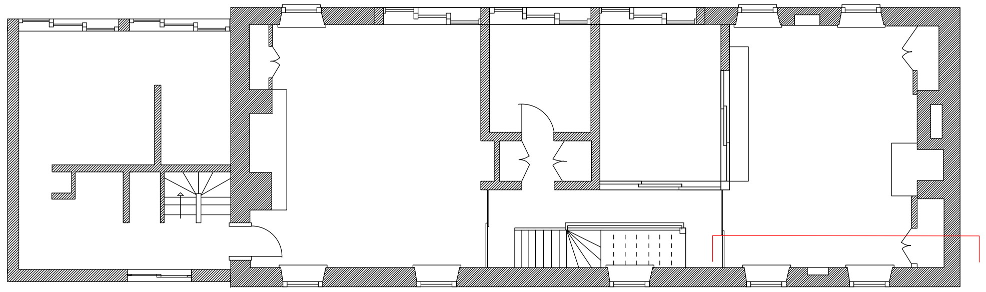

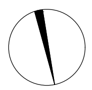

0 1' 2' 5' 10'

Scale 5/8" = 1'

Finish Failure

Previous Repair

Major Insulation Crack

Generalized Microcracking of Insulation

Sheet # 2.2

Room 2-A
North Interior Elevation

Farm House -

The Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey
Recorded and Prepared by
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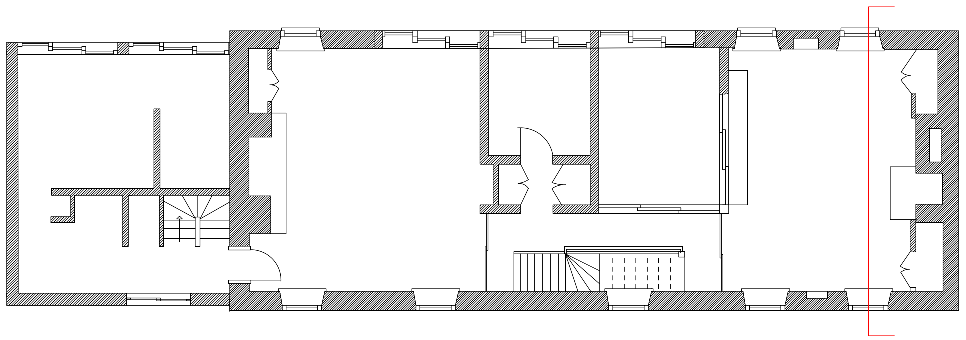

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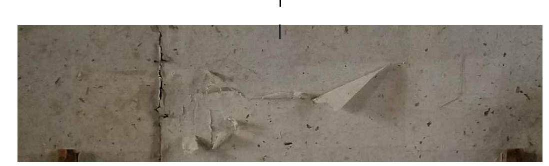
Finish Failure

Delaminating Veneer

Plaster Crack



The Raymond Farm Center for Living Arts and Design

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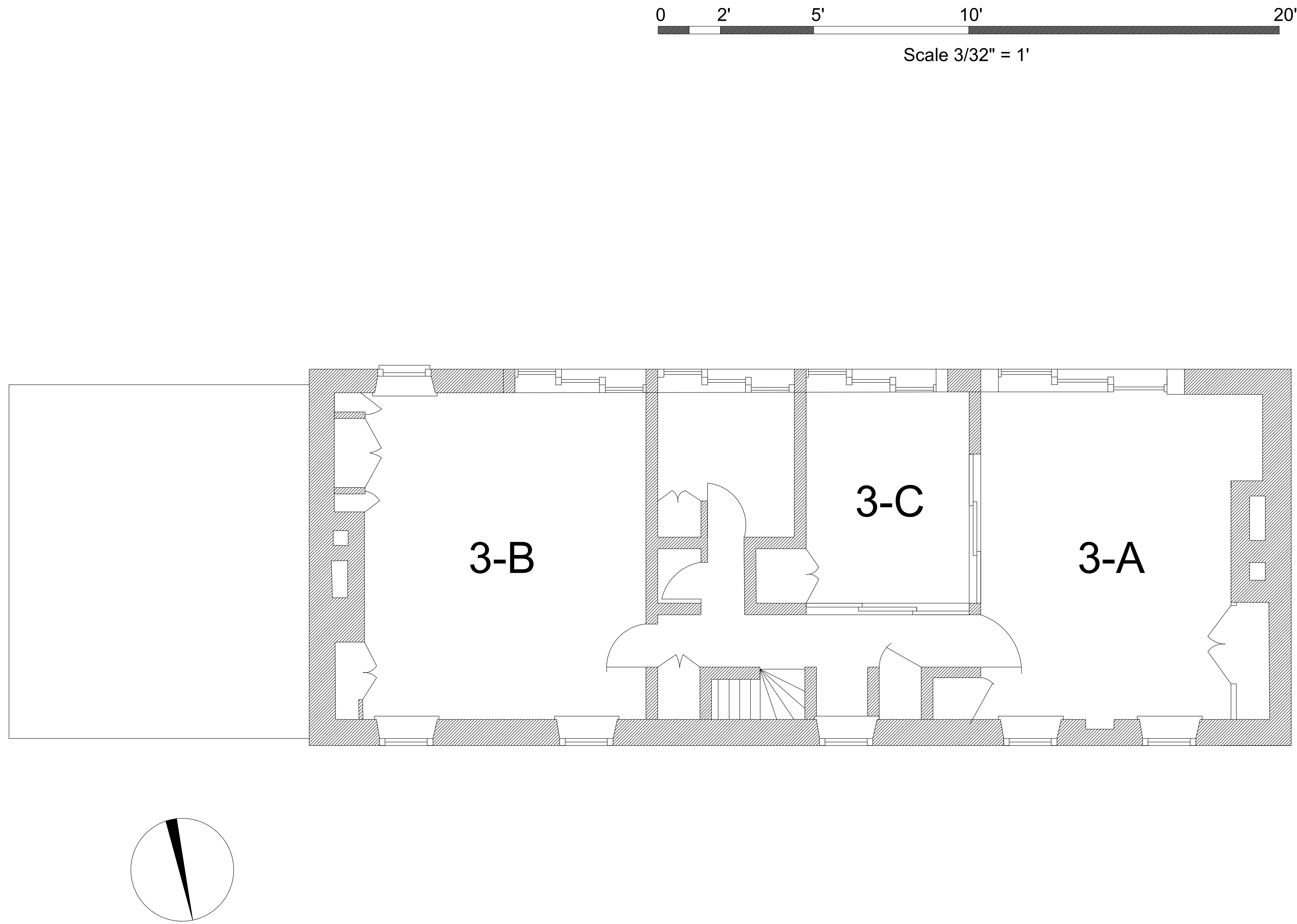
Condition Survey

Recorded and Prepared by Sara Gdula

Farm House - Room 2-A West Interior Elevation

Sheet # 2.3



Sheet #
3.1

Farm House - Third Floor Plan

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
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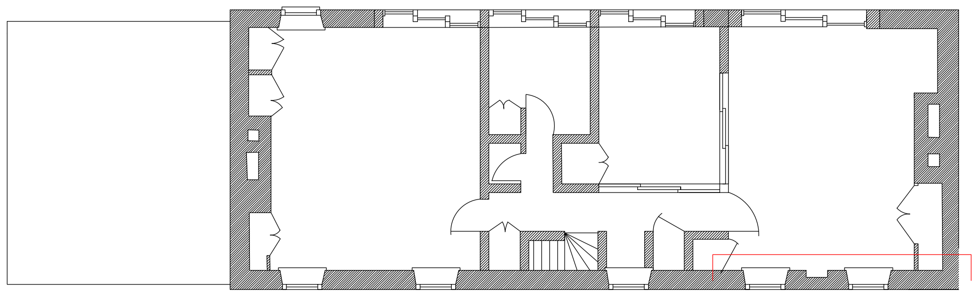
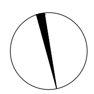
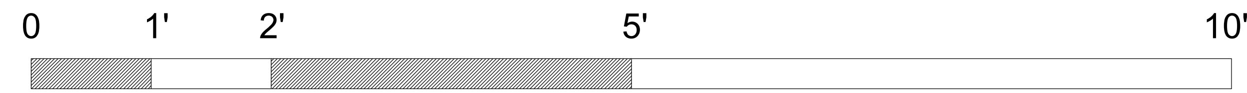


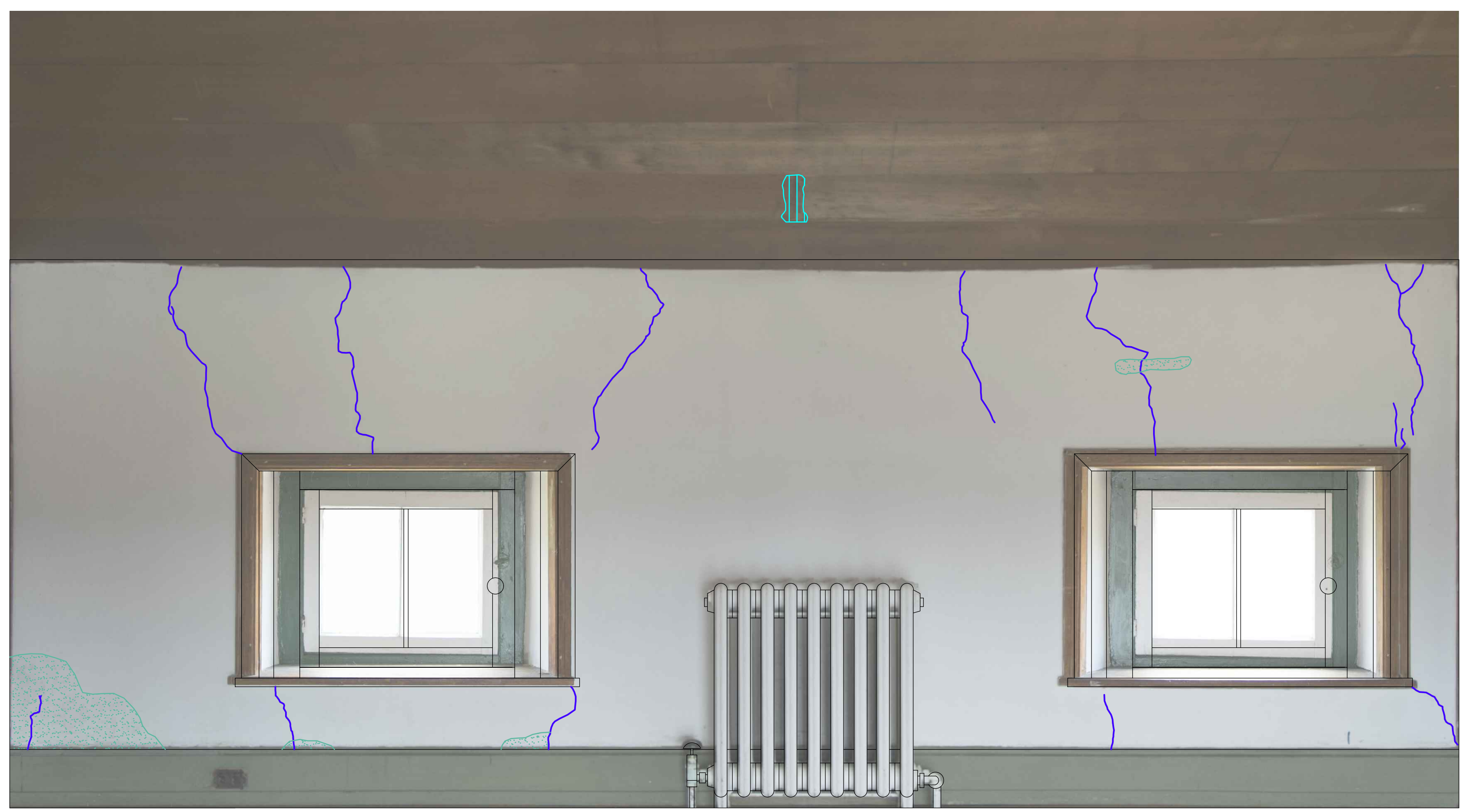




Scale 5/8" = 1'

Finish Failure

Plaster Crack



Sheet #
3.2

Farm House - Room 3-A
North Interior Elevation

Condition Survey
Recorded and Prepared by
Sara Gdula

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

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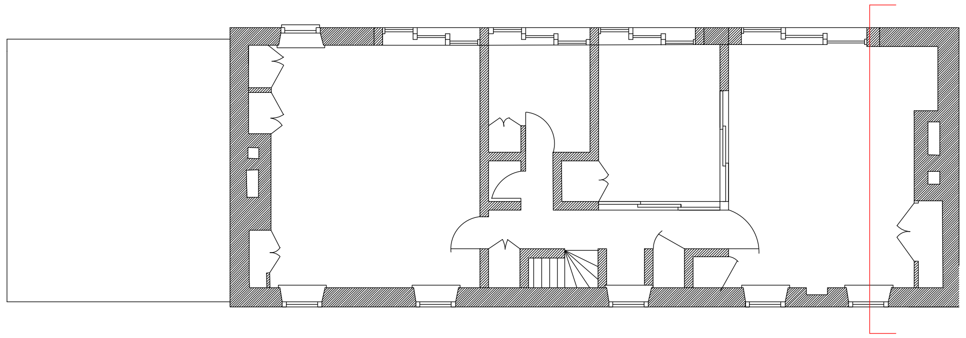

0 1' 2' 5' 10'

Scale 5/8" = 1'

- Water Staining
- Previous Repair
- Delaminating Veneer
- Loss of Veneer
- Plaster Crack

Sheet # 3.3

Farm House - Room 3-A West Interior Elevation

Condition Survey
Recorded and Prepared by Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
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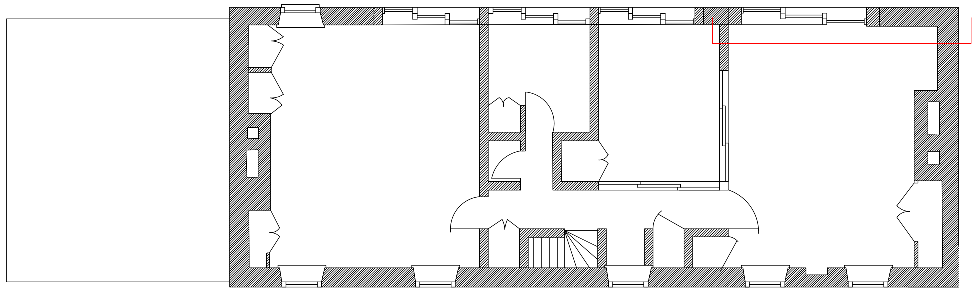

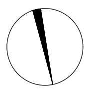

0 1' 2' 5' 10'

Scale 5/8" = 1'

Finish Failure

Paper Loss

Paper Delamination

Previous Repair

Sheet # 3.4

Farm House - Room 3-A South Interior Elevation

Condition Survey
Recorded and Prepared by Sara Gdula

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

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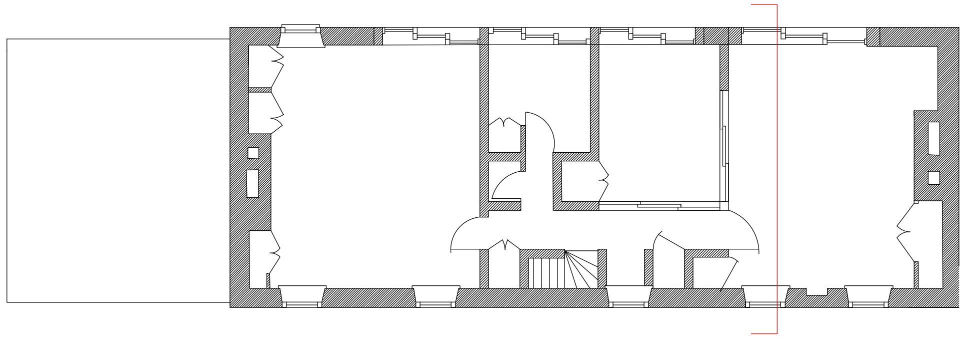

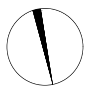

0 1' 2' 5' 10'

Scale 5/8" = 1'

Finish Failure

Paper Delamination

Paper Loss

Fusuma missing decorative paper

Sheet # 3.5

Farm House - Room 3-A East Interior Elevation

Condition Survey
Recorded and Prepared by Sara Gdula

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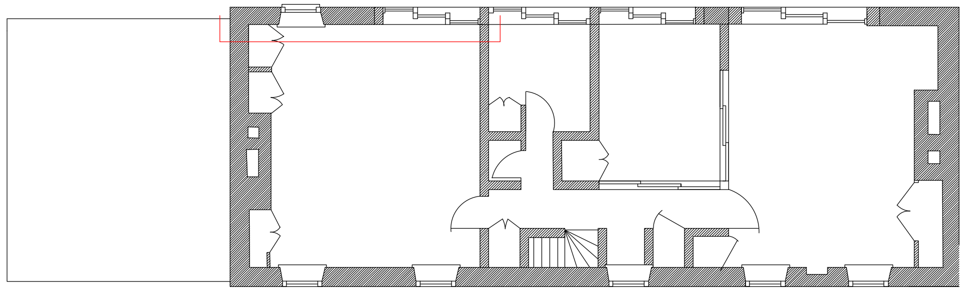

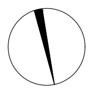

0 1' 2' 5' 10'

Scale 5/8" = 1'

Water Staining

Plaster Crack

Sheet #
3.6

Farm House - Room 3-B
South Interior Elevation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey
Recorded and Prepared by Sara Gdula

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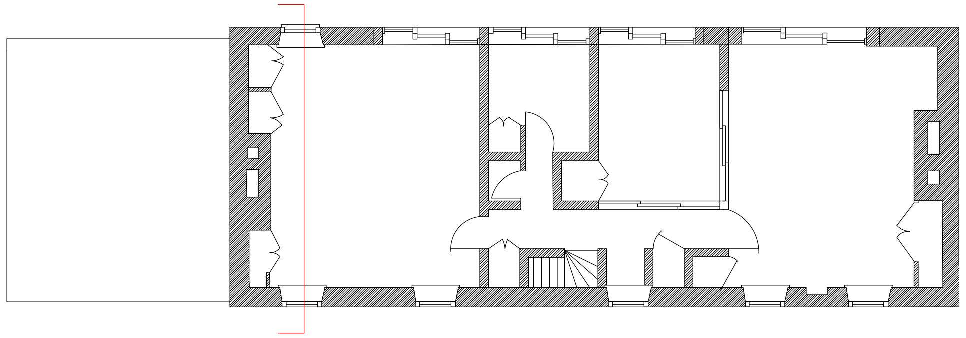
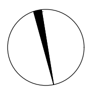
Graduate Program in Historic Preservation





0 1' 2' 5' 10'

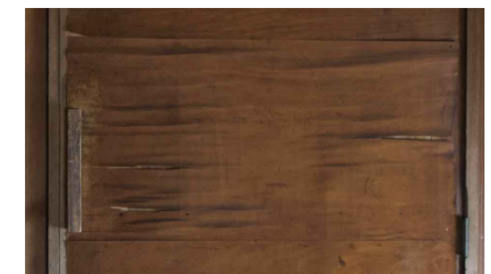
Scale 5/8" = 1'

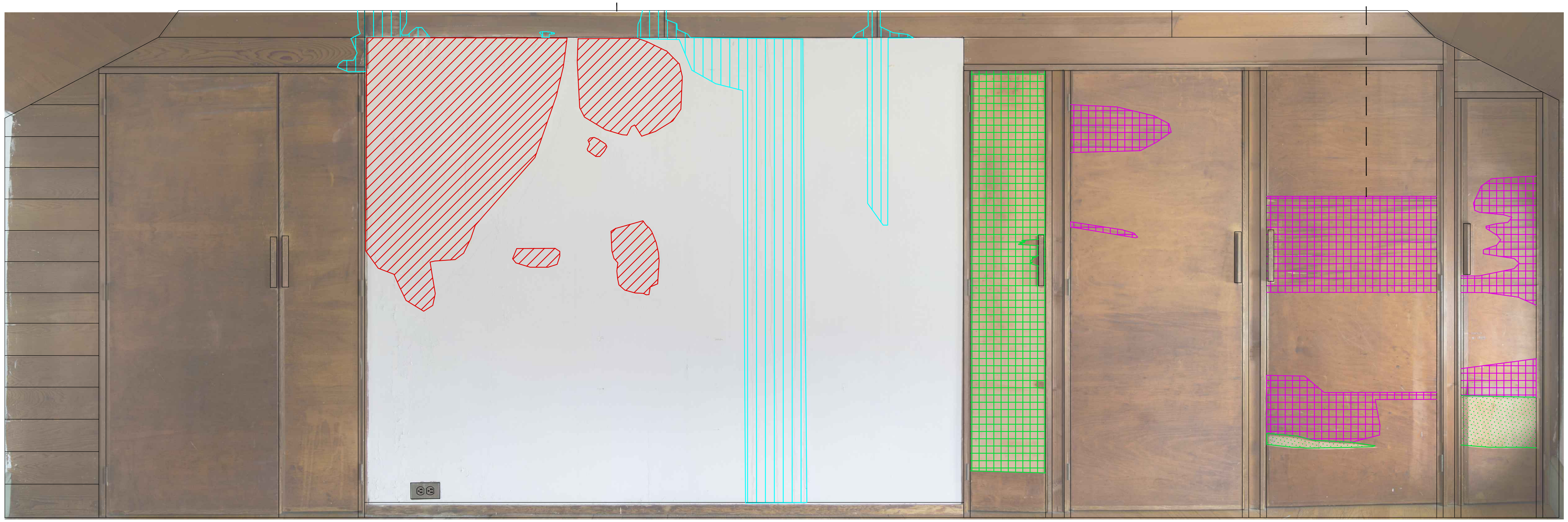
Water Staining

Previous Repair

Delaminating Veneer

Loss of Veneer





Sheet # 3.7

Farm House - Room 3-B East Interior Elevation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey
Recorded and Prepared by Sara Gdula

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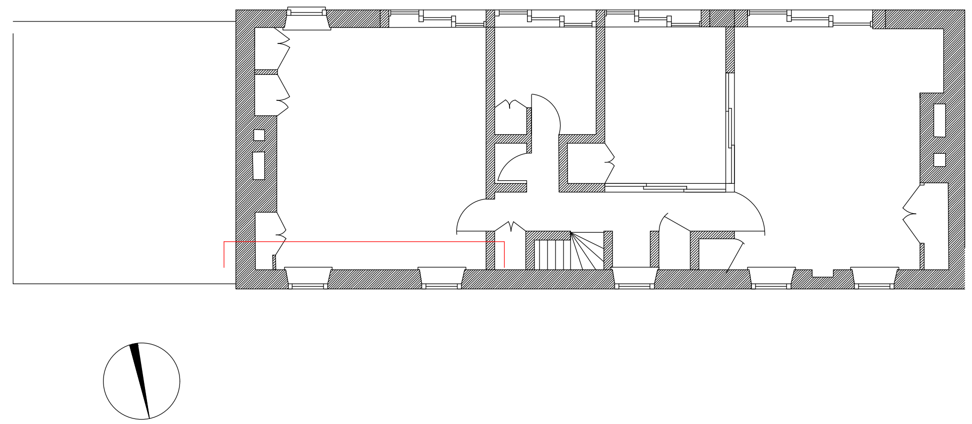

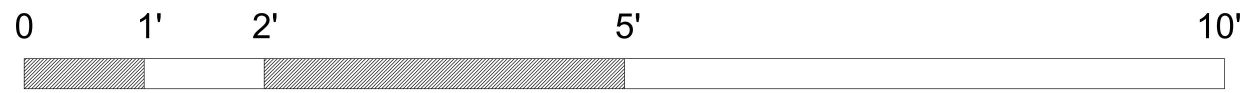

Scale 5/8" = 1'

Finish Failure

Water Staining

Plaster Crack

Sheet #
3.8

Farm House - Room 3-B
North Interior Elevation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Condition Survey
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
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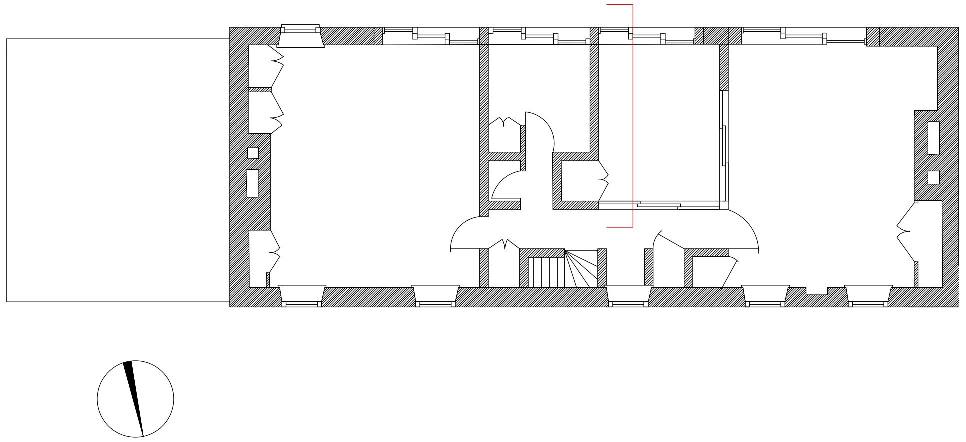


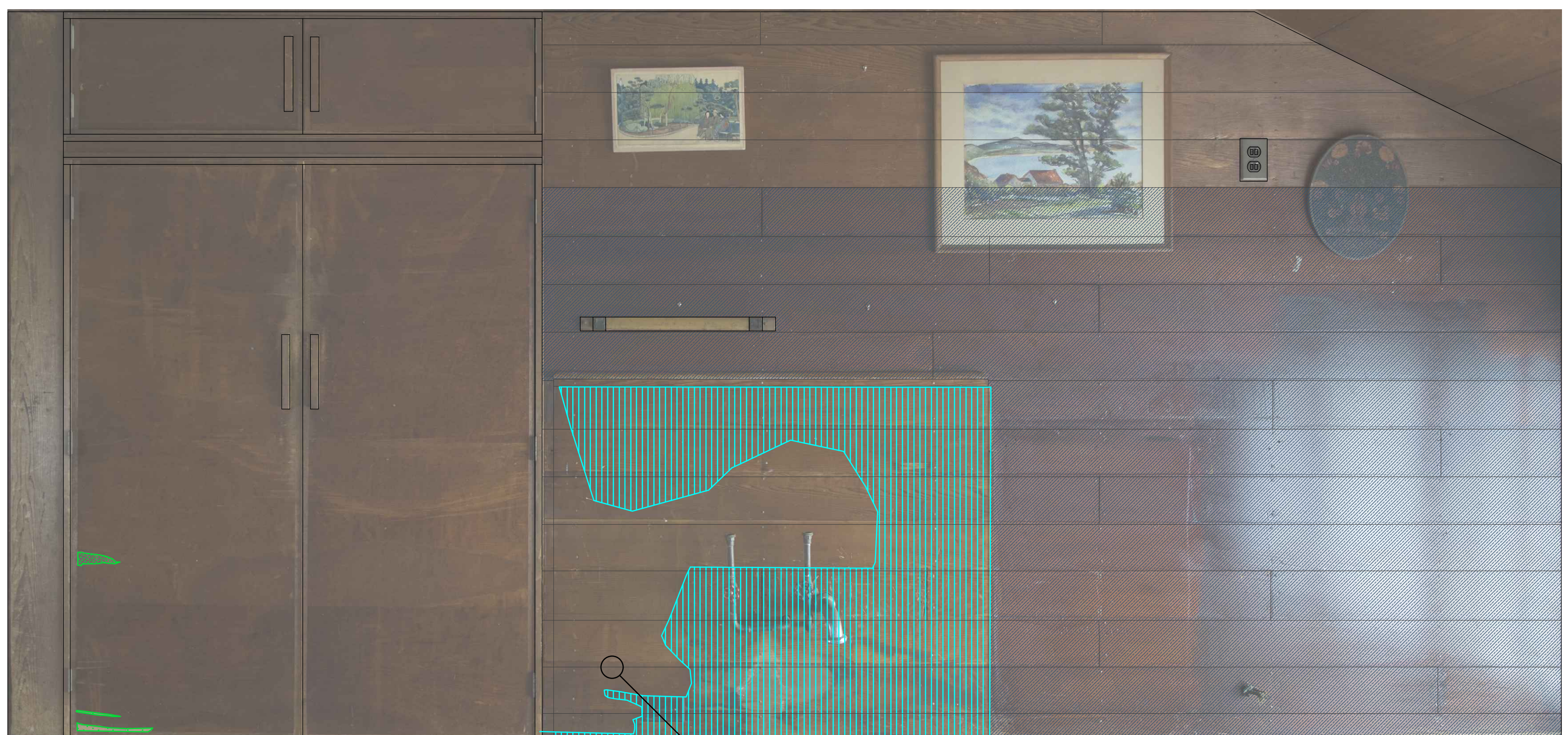
0 1' 2' 5' 10'

Scale 5/8" = 1'

Water Staining

Loss of Veneer

Water Repellant Coating



Ghost of previous kitchenette unit

Sheet #
3.9

Farm House - Room 3-C
East Interior Elevation

Condition Survey
Recorded and Prepared by
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The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road, New Hope, PA — Spring 2018

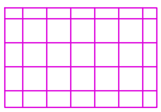
Farm House
Interior Condition Survey Glossary

University of Pennsylvania
Graduate Program in Historic Preservation

Condition: Delaminating Veneer

Definition: Cedar veneer is disassociating from the substrate, however is still connected in at least one point.

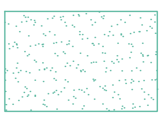
Graphic:



Condition: Finish Failure

Definition: Finish is either flaking or has been removed entirely to reveal the substrate underneath.

Graphic:



Condition: Major Cracking of Rigid Insulation

Definition: Crack in the rigid insulation that is wider than 0.010 inches.

Graphic:

Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road, New Hope, PA

Spring 2018

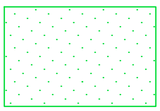
Farm House
Interior Condition Survey Glossary

University of Pennsylvania
Graduate Program in Historic Preservation

Condition: Loss of Veneer

Definition: Cedar veneer has disassociated from the substrate and is no longer connected or present.

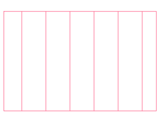
Graphic:



Condition: Paper Delamination

Definition: Paper veneer is disassociating from the substrate, however is still connected in at least one point.

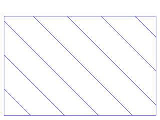
Graphic:



Condition: Paper Loss

Definition: Cedar veneer has disassociated from the substrate and is no longer connected or present.

Graphic:



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6370 Pidcock Creek Road, New Hope, PA
Spring 2018

Farm House
Interior Condition Survey Glossary

University of Pennsylvania
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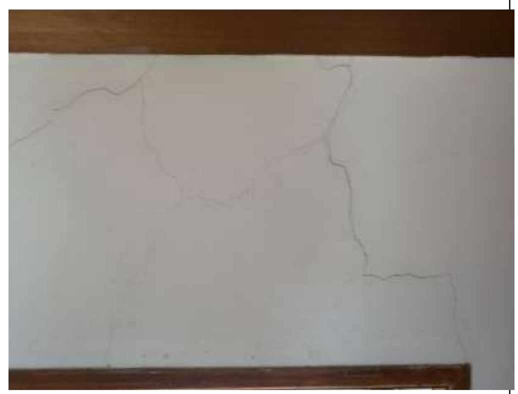
Condition: Plaster Crack

Definition: Crack in the plaster that is wider than 0.005 inches.

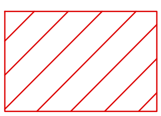


Graphic:

Condition: Previous Repair

Definition: Repair material over previous condition.

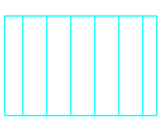
Graphic:



Condition: Water Staining

Definition: Discolorations on the substrate due to a singular or multiple periods of wetting.

Graphic:



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6370 Pidcock Creek Road, New Hope, PA — Spring 2018

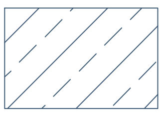
Farm House
Interior Condition Survey Glossary

University of Pennsylvania
Graduate Program in Historic Preservation

Condition: Water Repellant Coating

Definition: Coating on wood substrate to protect it from nearby water sources.

Graphic:



Condition: Wood Check or Split

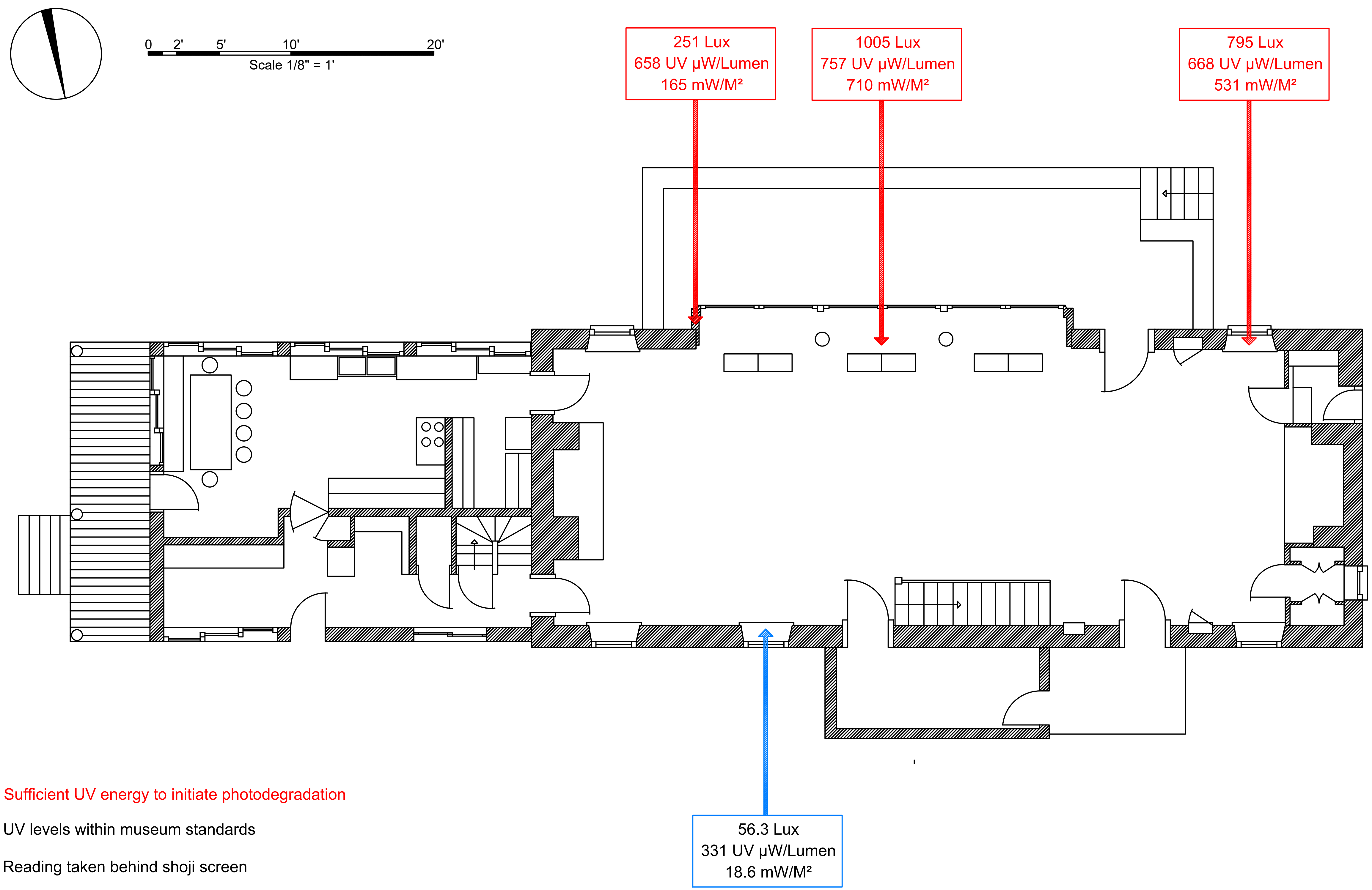
Definition: A crack in wood that forms due to moisture content and temperature cycles. When this occurs naturally it is defined as a check, when due to exterior fixedy it is defined as a split.

Graphic:

Appendix C: Ultraviolet Light Data

Recorded November 18, 2017
Using an Elsec 765 Environmental Monitor
Conditions: Overcast and Rain

Created by: Sara Gdula



= Sufficient UV energy to initiate photodegradation

= UV levels within museum standards

= Reading taken behind shoji screen

Readings Taken November 18, 2017

using Elsec 765 Environmental Monitor

Conditions: Overcast and Rain

Sheet # 6.1

Farm House - First Floor Floor Plan

UV Levels

Recorded and Prepared by Sara Gdula

The Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road New Hope, PA Spring 2018

University of Pennsylvania

Graduate Program in Historic Preservation

Sheet # 6.2

The Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road New Hope, PA Spring 2018

Farm House - Second Floor Floor Plan

UV Levels

Recorded and Prepared by Sara Gdula

University of Pennsylvania

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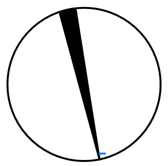
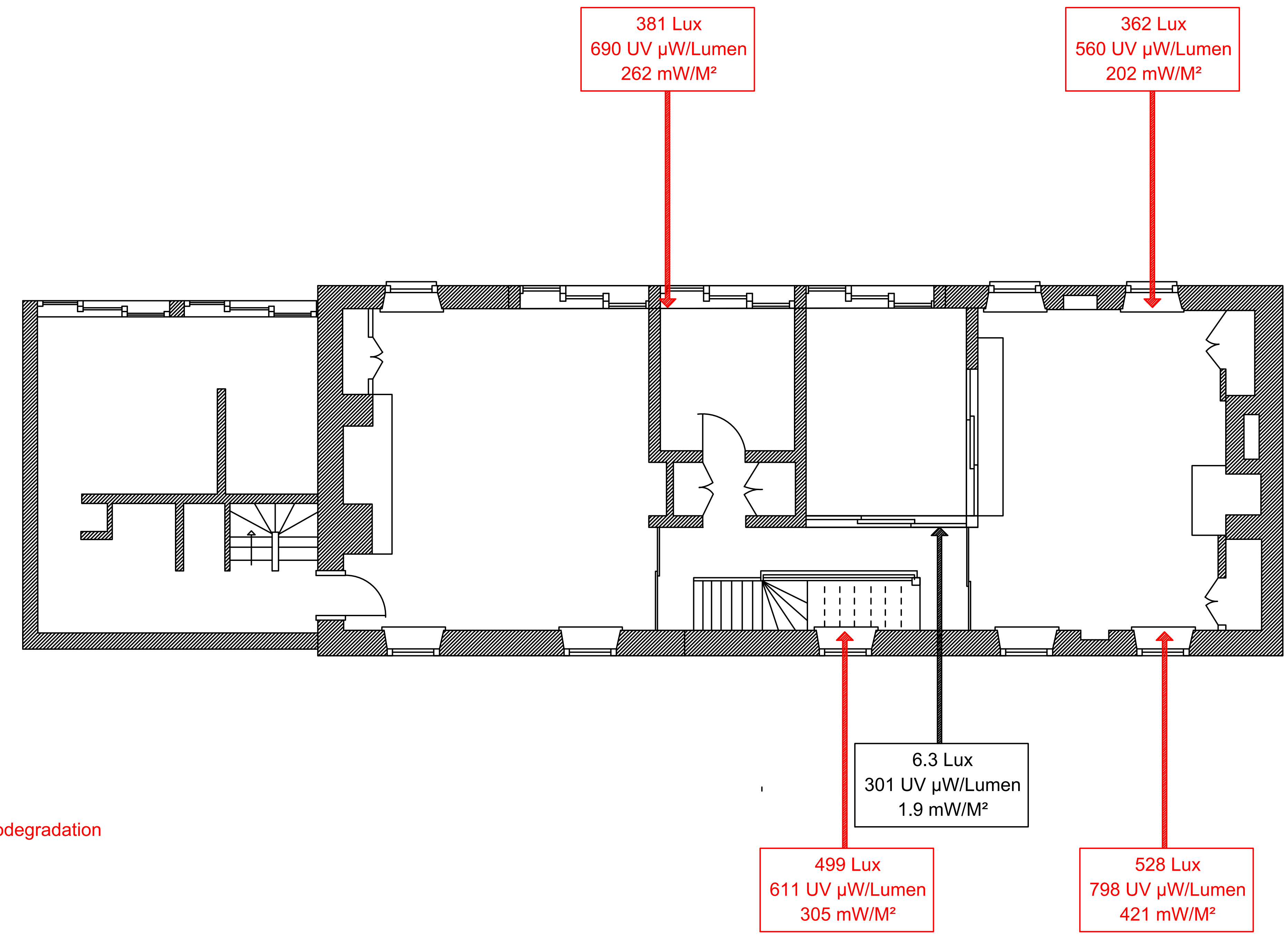


0 2' 5' 10' 20'

Scale 1/8" = 1'



= Sufficient UV energy to initiate photodegradation

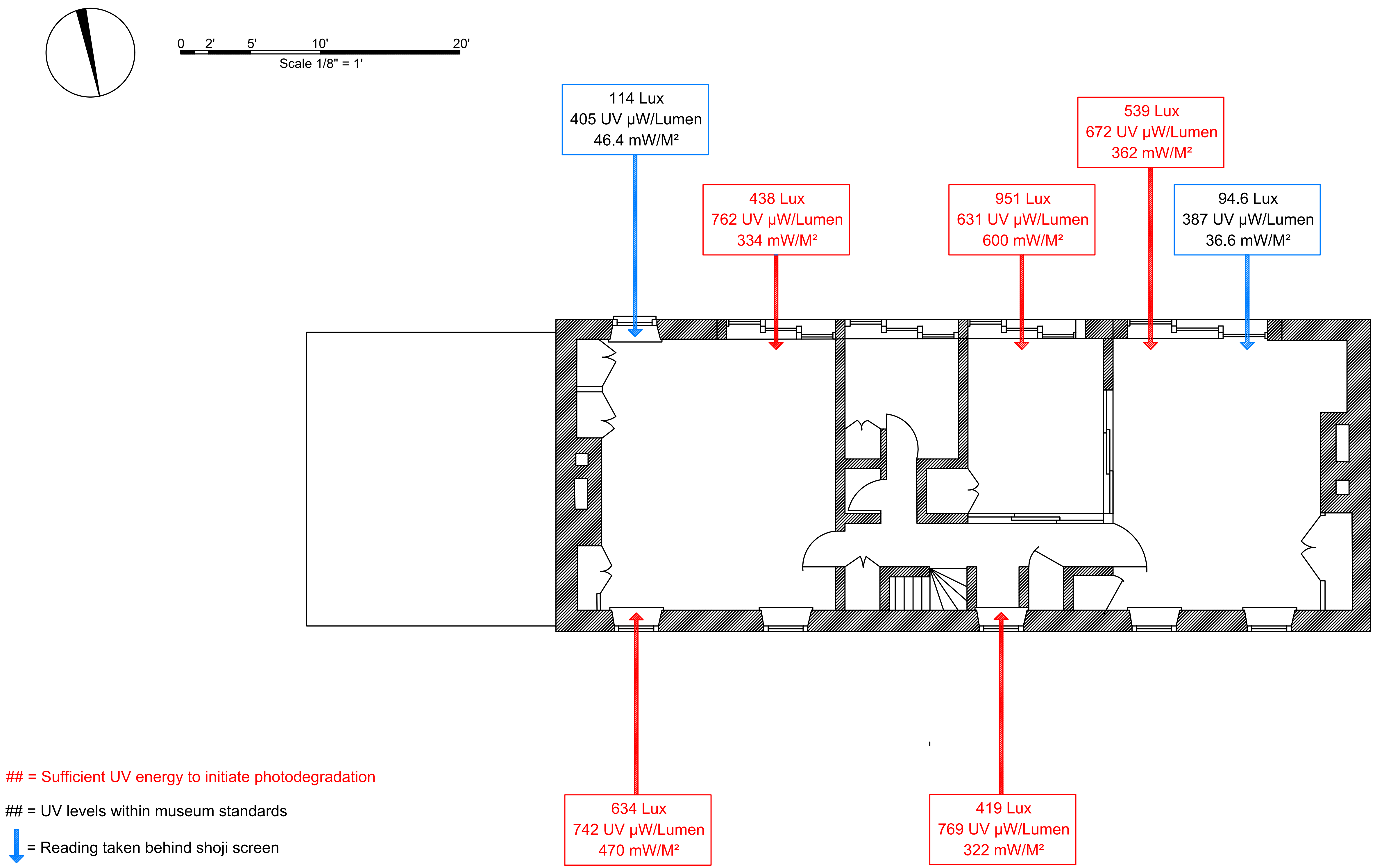
= UV levels within museum standards

= Reading taken behind shoji screen

Readings Taken November 18, 2017

using Elsec 765 Environmental Monitor

Conditions: Overcast and Rain



Readings Taken November 18, 2017
using Elsec 765 Environmental Monitor
Conditions: Overcast and Rain

Sheet #
6.3

Farm House - Third Floor Floor Plan

UV Levels
Recorded and Prepared by Sara Gdula

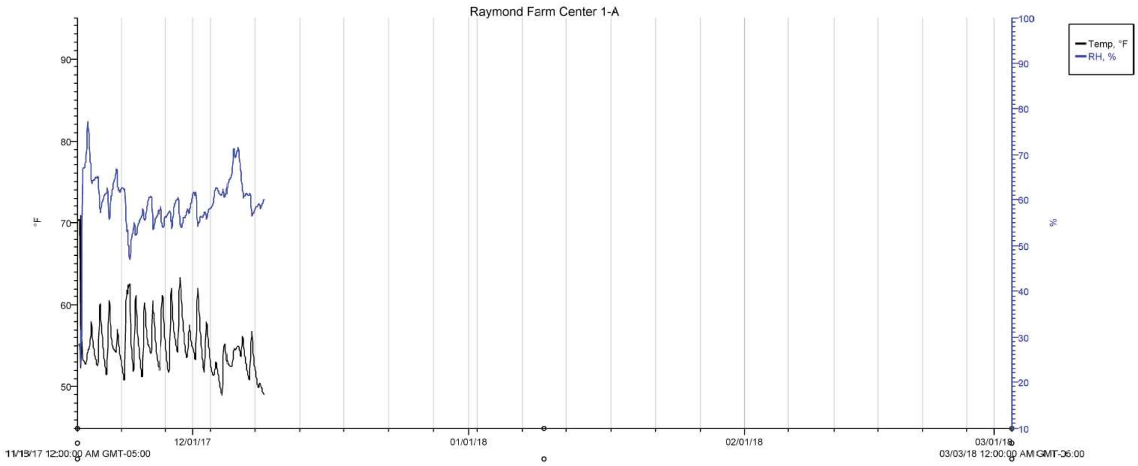
The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

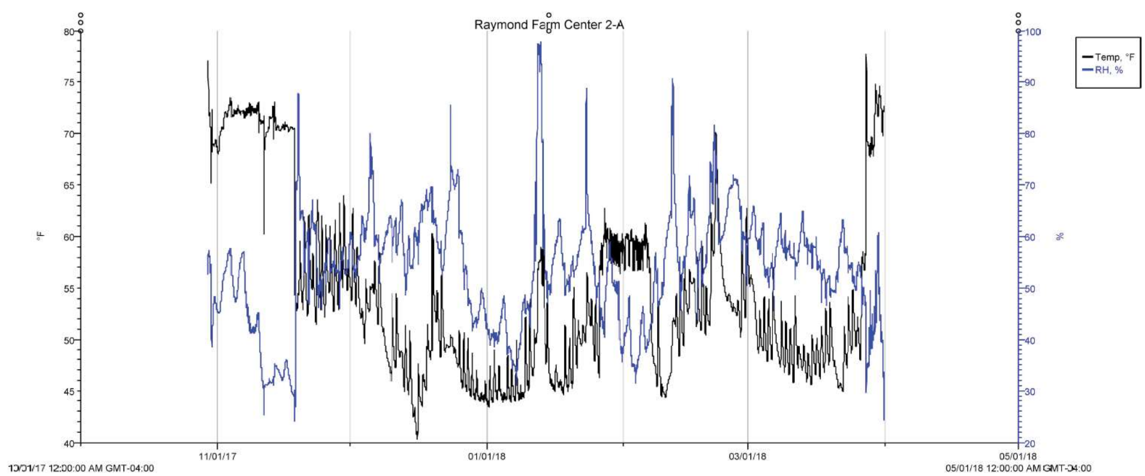
University of Pennsylvania
Graduate Program in Historic Preservation

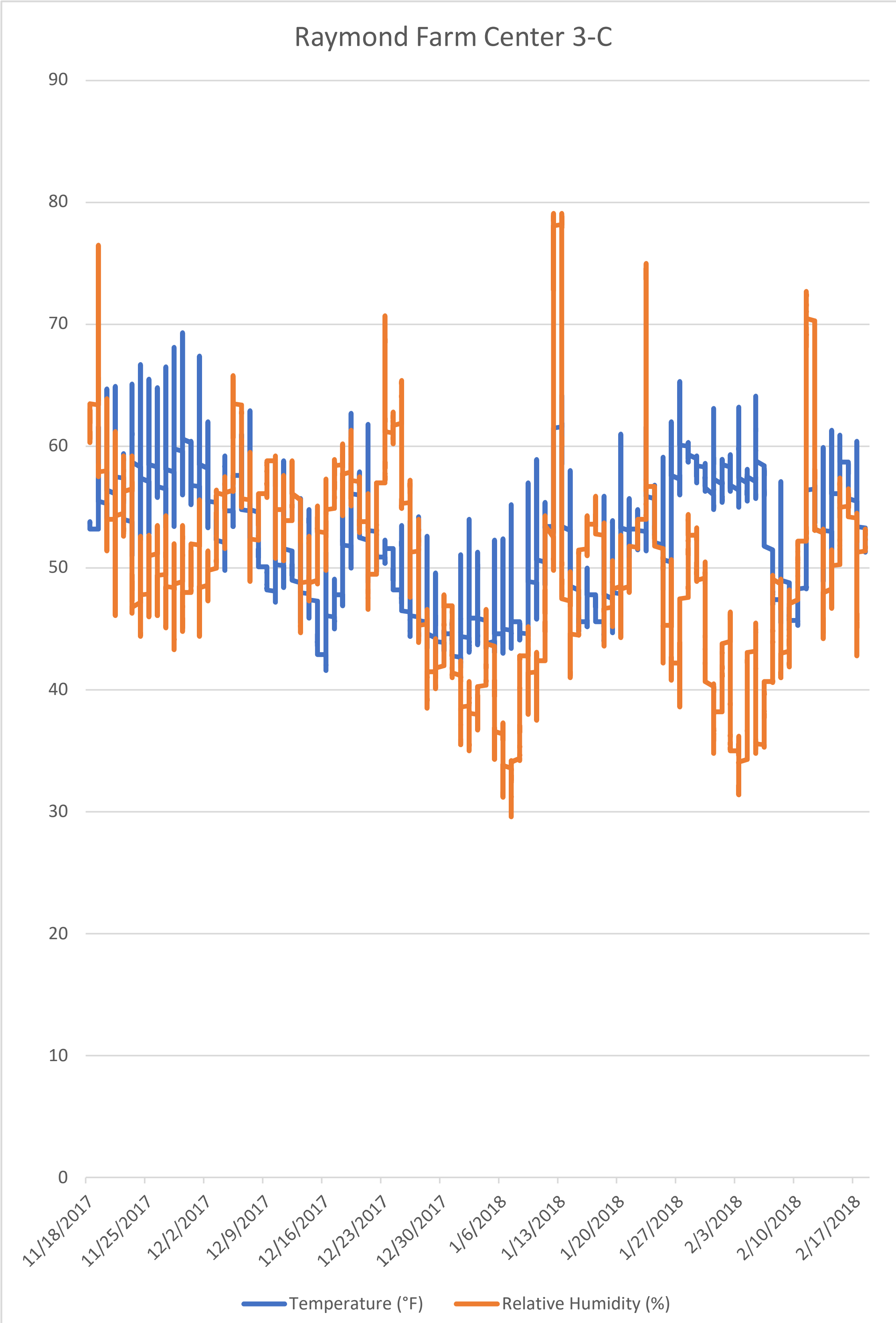
<u>Appendix D: Environmental Monitoring Data</u>

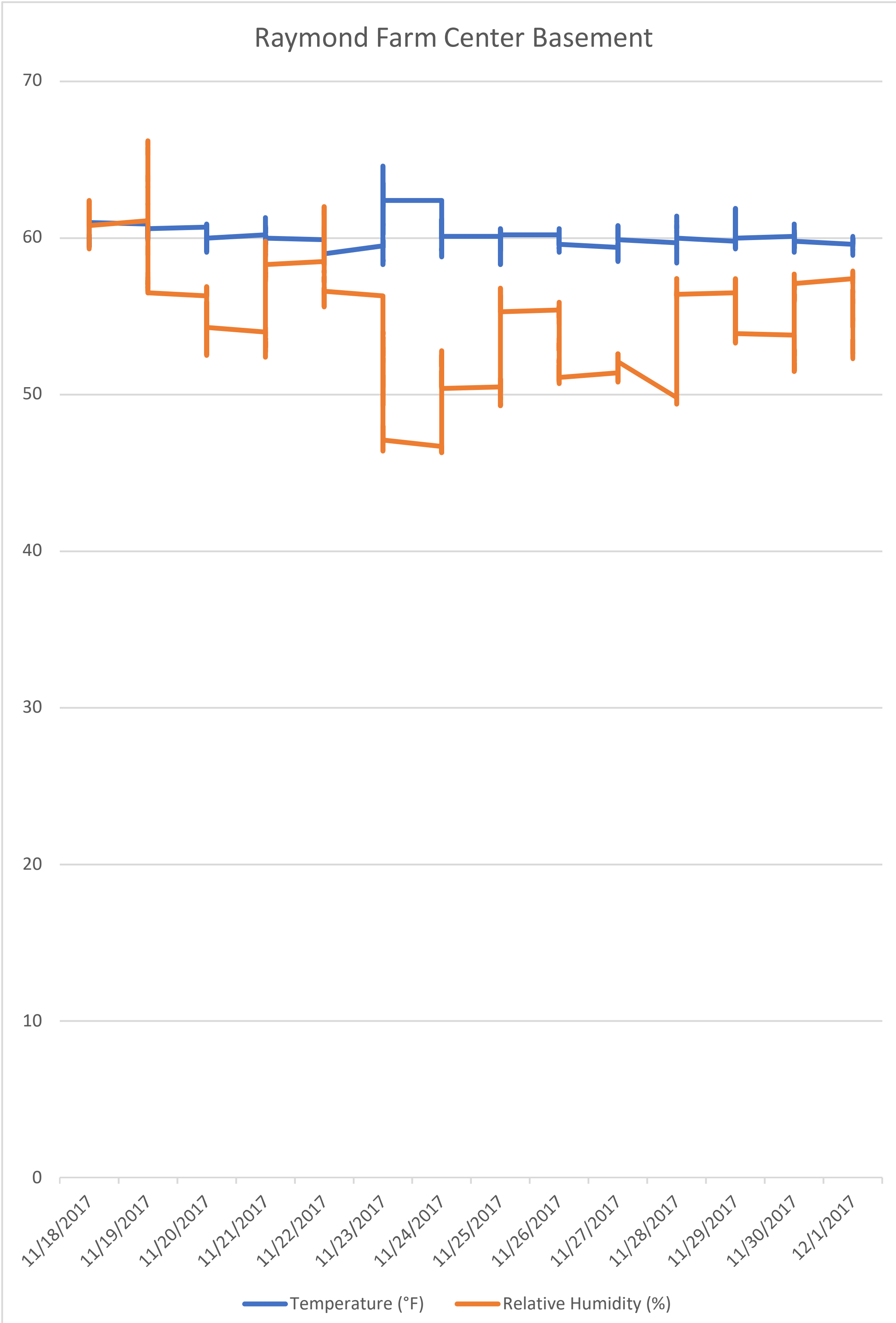
Recorded November 18, 2017-April 10, 2018
Using 2 Onset temp/RH loggers

Created by: Sara Gdula


Raymond Farm Center 1-A
Temp, °F
RH, %
°F
%
12/01/17
01/01/18
02/01/18
03/01/18
11/18/17 12:00:00 AM GMT-05:00
03/03/18 12:00:00 AM GMT-06:00


Raymond Farm Center 2-A
Temp, °F
RH, %
°F
%
11/01/17
01/01/18
03/01/18
05/01/18
10/01/17 12:00:00 AM GMT-04:00
05/01/18 12:00:00 AM GMT-04:00


Raymond Farm Center 3-C
90
80
70
60
50
40
30
20
10
0
11/18/2017
11/25/2017
12/2/2017
12/9/2017
12/16/2017
12/23/2017
12/30/2017
1/6/2018
1/13/2018
1/20/2018
1/27/2018
2/3/2018
2/10/2018
2/17/2018
Temperature (°F)
Relative Humidity (%)

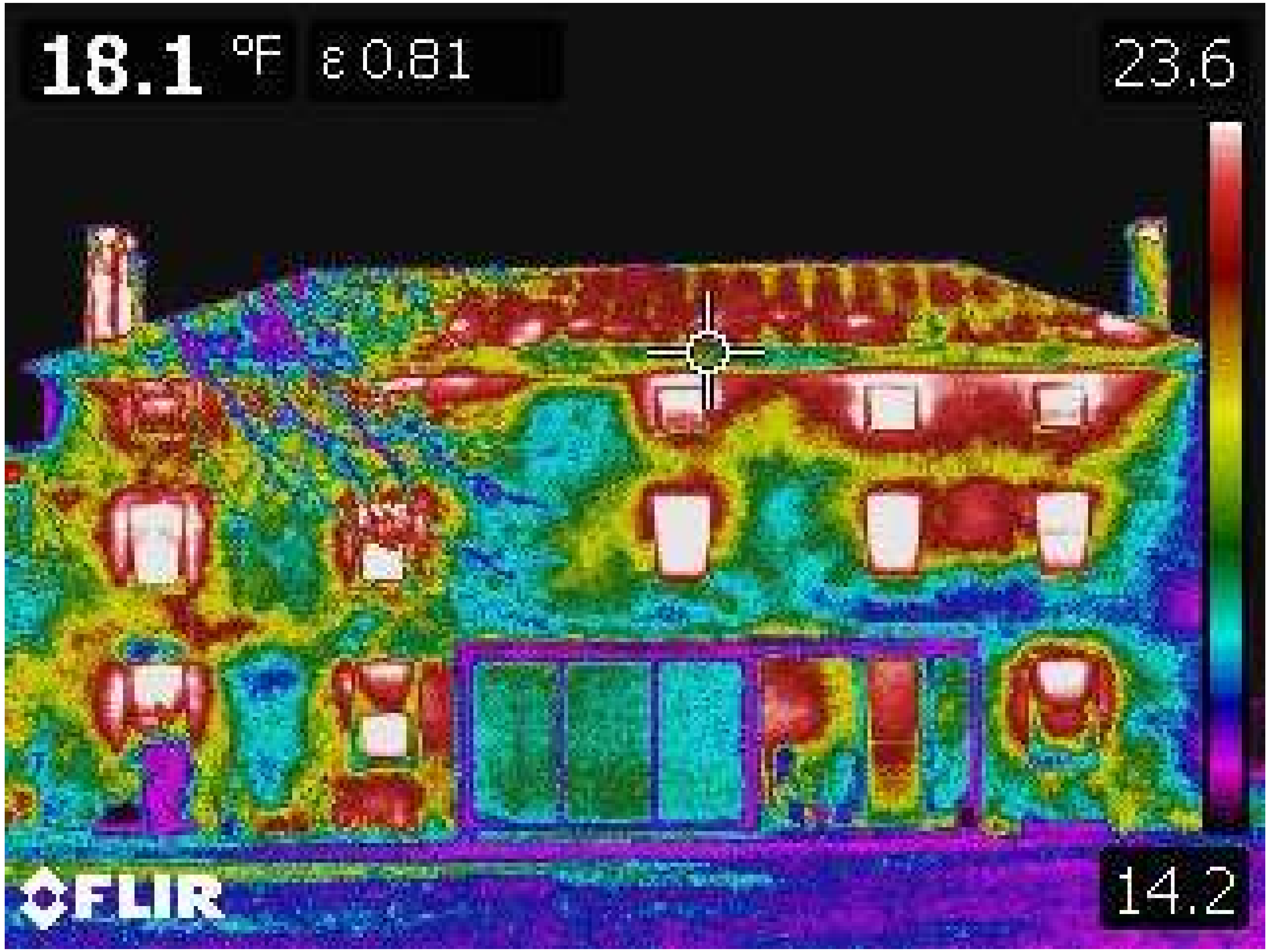


Raymond Farm Center Basement
70
60
50
40
30
20
10
0
11/18/2017
11/19/2017
11/20/2017
11/21/2017
11/22/2017
11/23/2017
11/24/2017
11/25/2017
11/26/2017
11/27/2017
11/28/2017
11/29/2017
11/30/2017
12/1/2017
Temperature (°F)
Relative Humidity (%)

Appendix E: Infrared Thermography

Recorded February 6, 2018
Using FLIR E4 Infrared Camera
Conditions: Overcast, High 38°F Low 23°F

Created by: Sara Gdula



Notes: Heat escaping from interior through glass of windows as well as the eastern chimney. Areas of stucco show a lower temperature as the stucco acts as an insulator. Tree branch obfuscating portions of the roof, 2nd and 3rd floor. Roof showing high temperature, meaning heat is entering the attic space between insulation and roofing materials, and is therefore dissipating into the outer atmosphere.
Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.

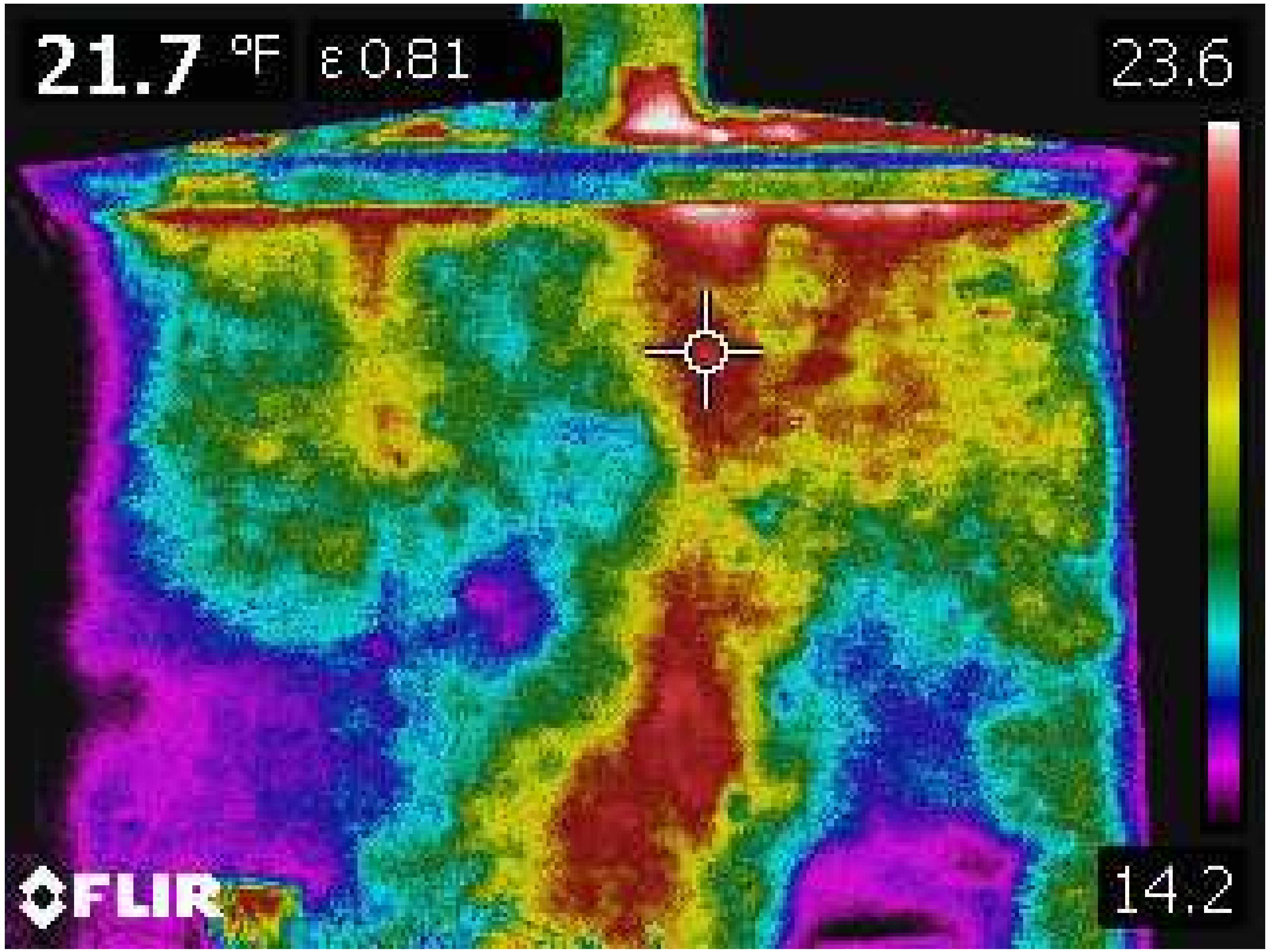
Sheet #
IR.1

Farm House - North Exterior Elevation

Infrared Thermography
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018



Notes: Higher thermal activity on west elevation follows chimney passages where distance between the interior and the exterior is shorter. Higher thermal activity along the roofline indicate areas where heat from the attic interior is escaping and heating the exterior roofing materials.

Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.

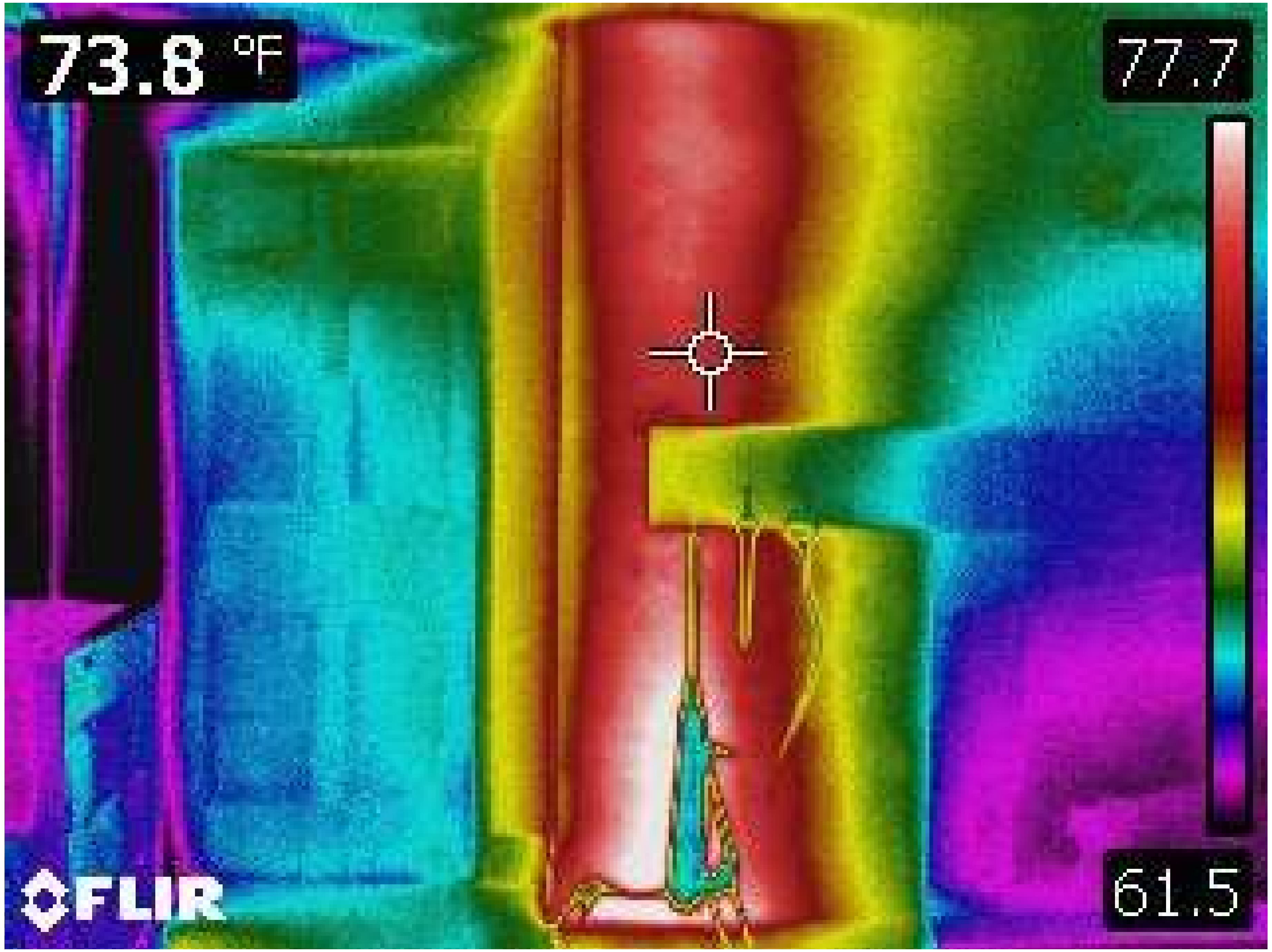
Sheet #
IR.2

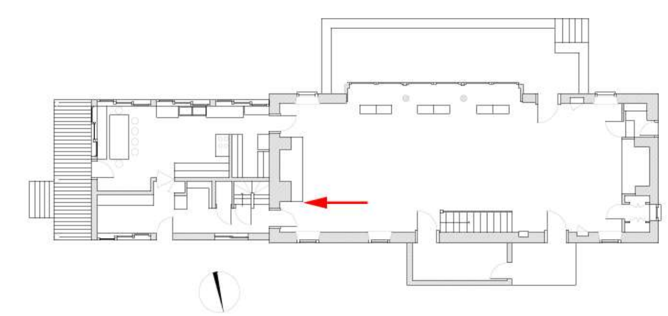
Farm House - West Exterior Elevation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Infrared Thermography
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation





Notes: First floor main room. Hot water pipe embedded in the masonry travelling from the water heater in the basement to the upper floor radiators. This constant heat in the winter causes finish failure on the surrounding wall surfaces. This heating system is eventually leaking into the attic space above the layer of blown insulation.

Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.

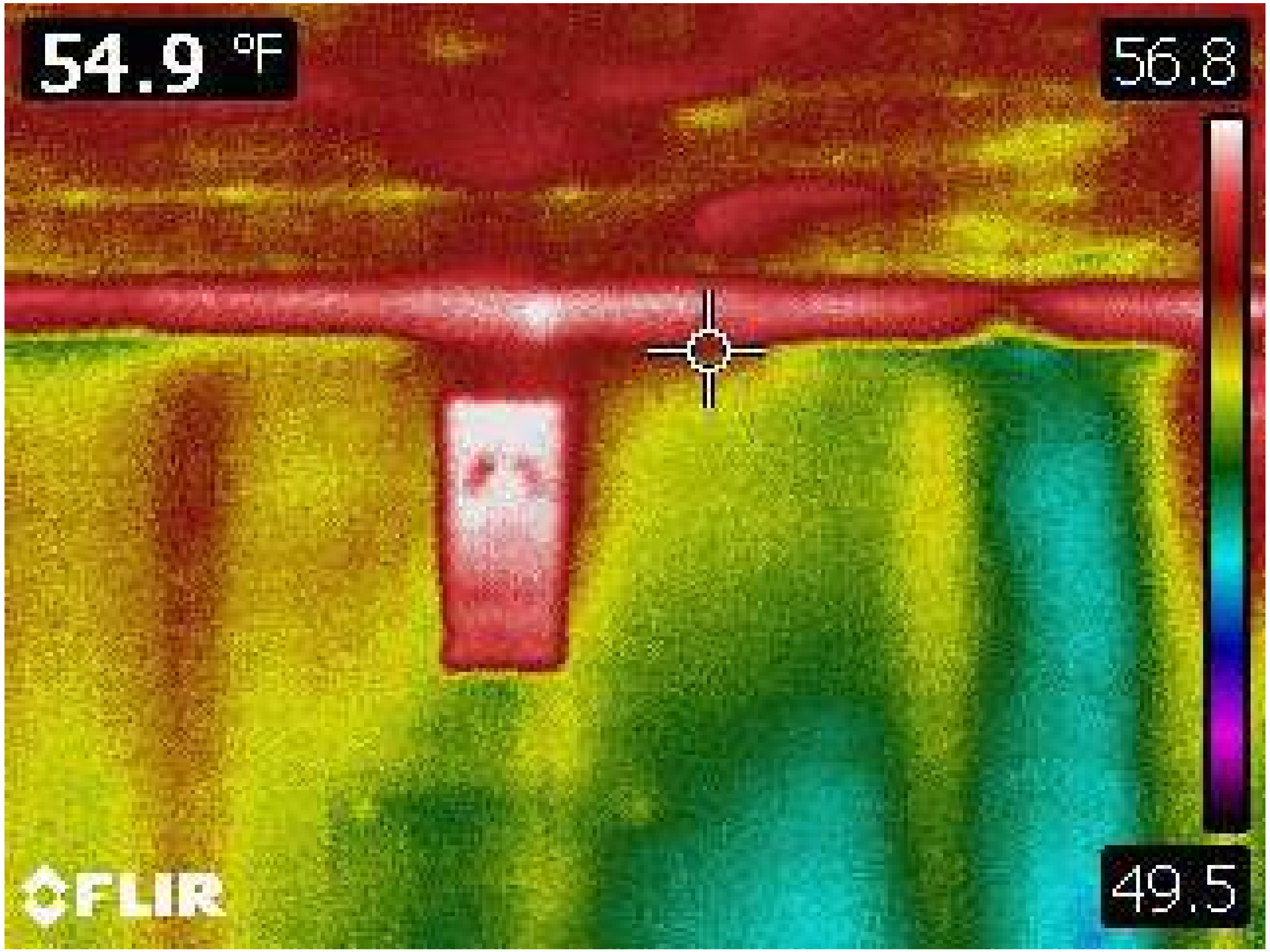
Sheet #
IR.3

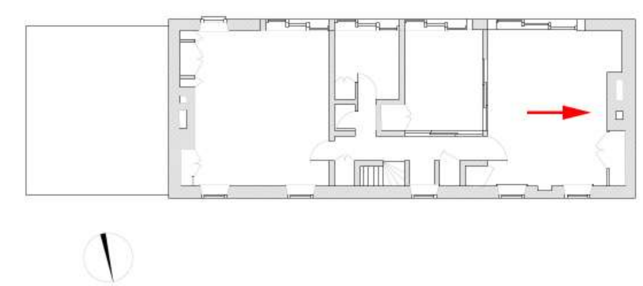
Farm House - 1-A East Interior Elevation

Infrared Thermography
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018





Notes: Third floor western bedroom. Heat trapped in the attic is entering the bedroom through joints in the woodwork at between the wood and masonry. Small amounts of liquid water is also likely leaking through the roof to enter the interior here.

Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.

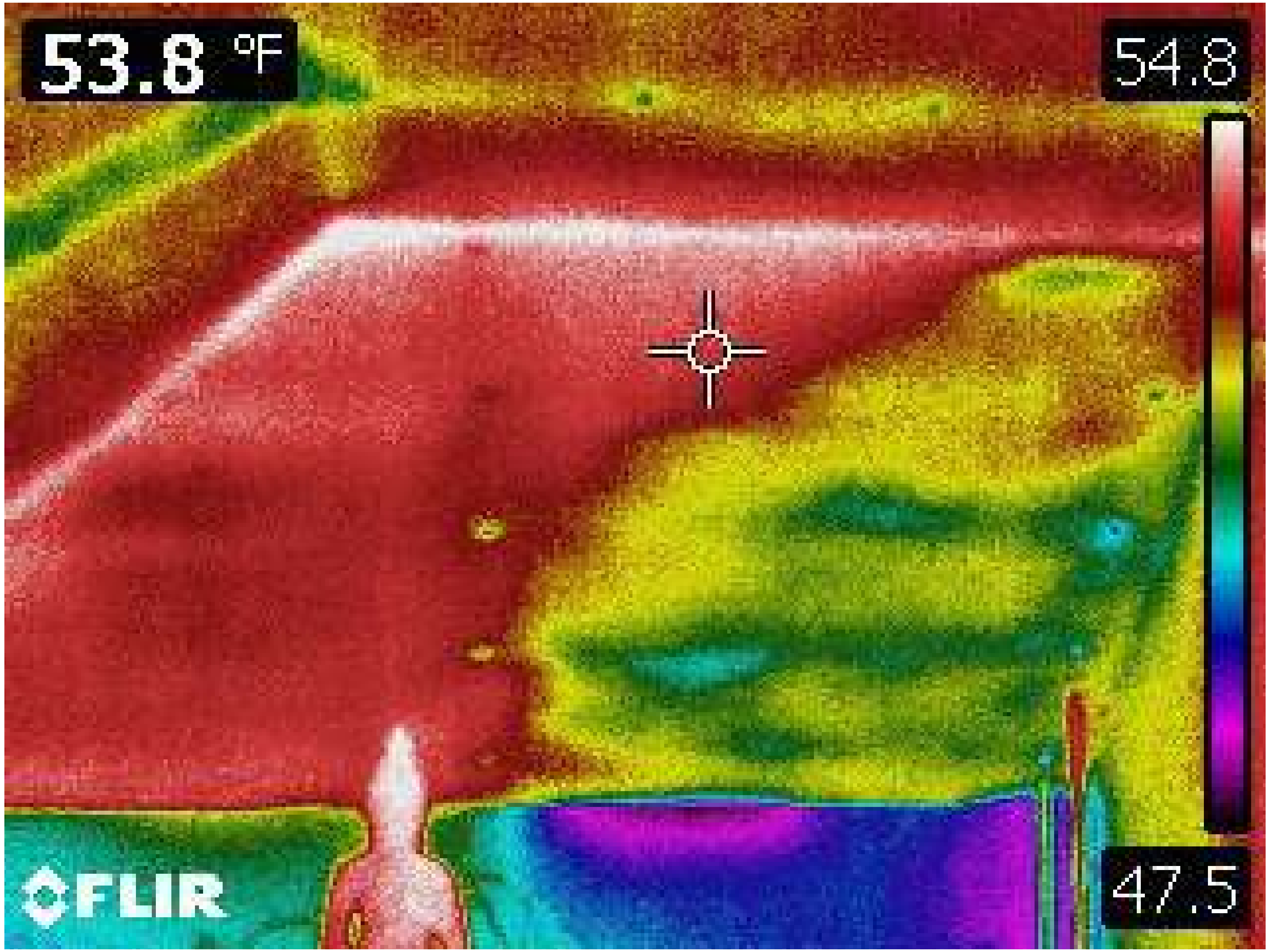
Sheet #
IR.4

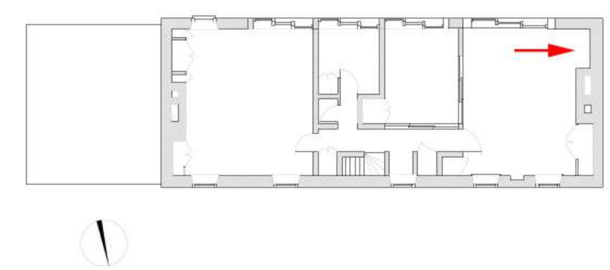
Farm House - 3-A West Interior Elevation

Infrared Thermography
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018





Sheet #
IR.5

Farm House - 3-A West Interior Elevation

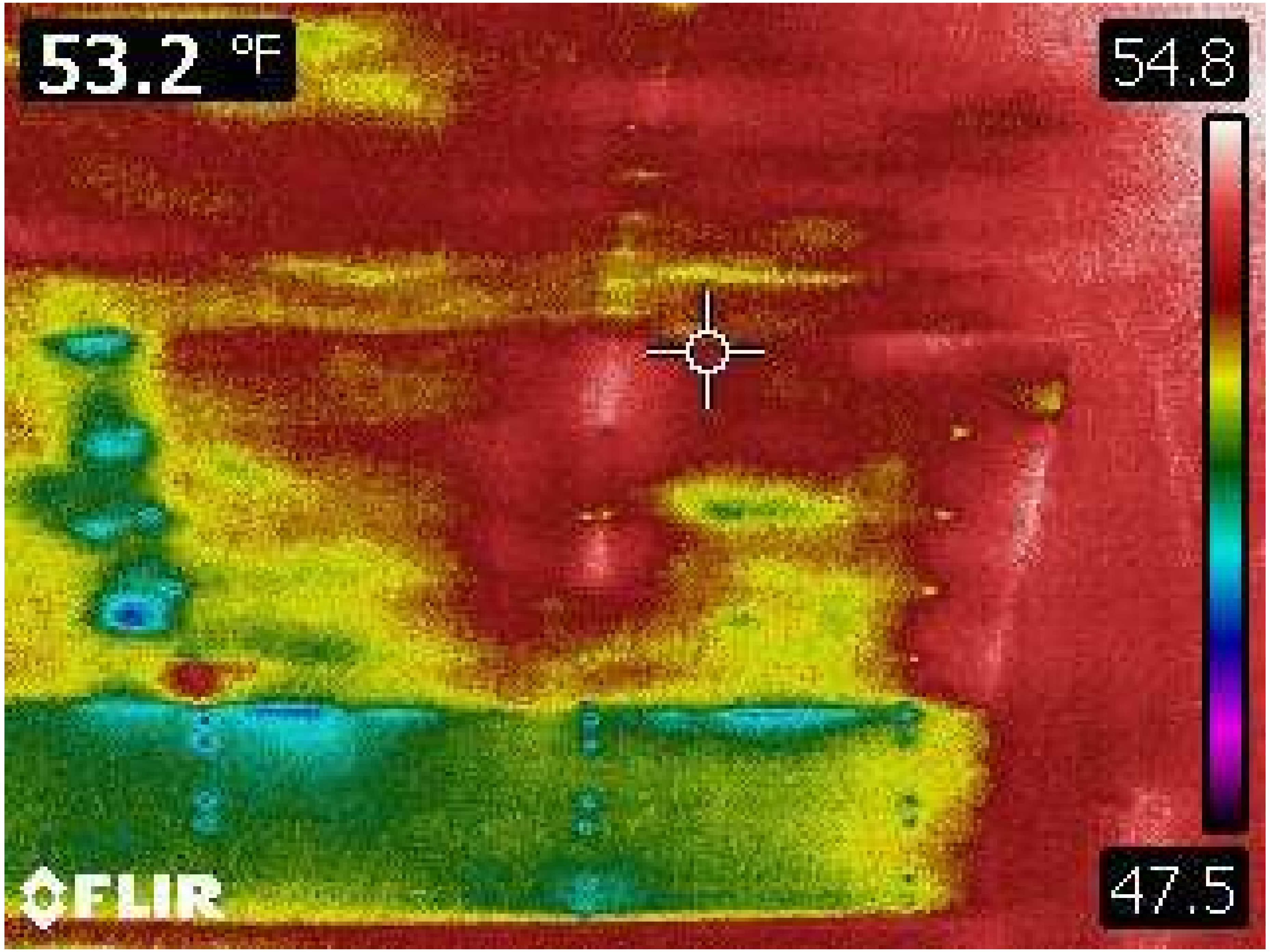
Infrared Thermography
Recorded and Prepared by
Sara Gdula

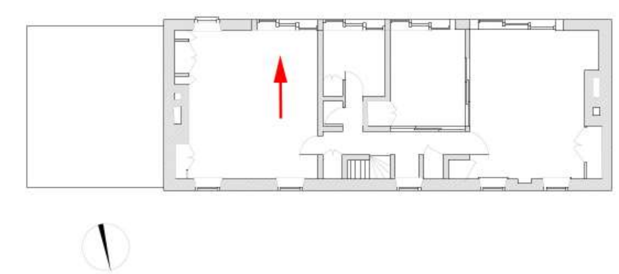
University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Notes: Third floor western bedroom. Heat trapped in the attic is entering the bedroom through joints in the woodwork at between the wood and masonry. Small amounts of liquid water is also likely leaking through the roof to enter the interior here.

Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.





Notes: Third floor eastern bedroom south wall. Areas of higher thermal activity are areas that show black iron water staining. Mild cupping allowing heat trapped in the attic space to enter the room through crevices in the wood. Surrounding wood likely retaining heat due to higher moisture content, indicative of an active leak.

Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.

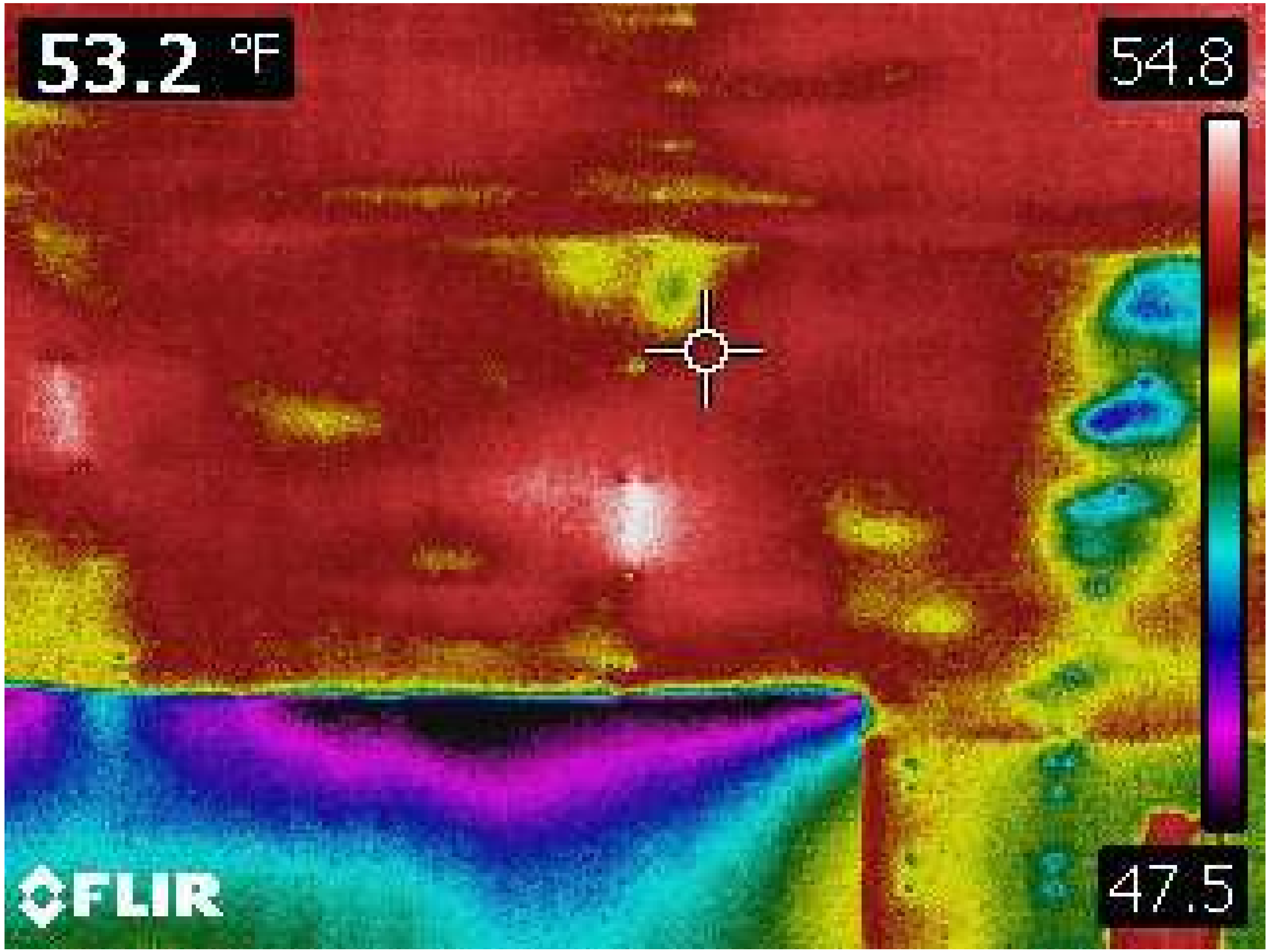
Sheet #
IR.6

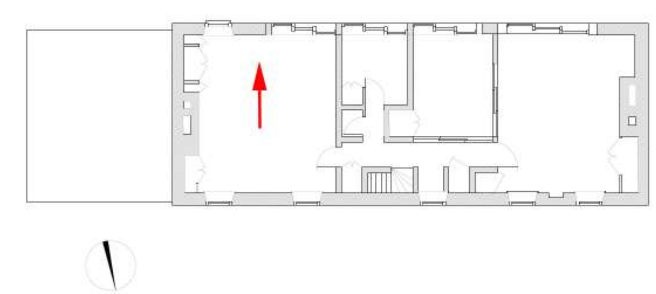
Farm House - 3-B South Interior Elevation

Infrared Thermography
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018





Notes: Third floor eastern bedroom south wall. Areas of higher thermal activity are areas that show black iron water staining. Mild cupping allowing heat trapped in the attic space to enter the room through crevices in the wood. Surrounding wood likely retaining heat due to higher moisture content, indicative of an active leak.

Conditions: Overcast afternoon, high of 38 °F low of 23°F Rain event two days prior.

Sheet #

IR.7

Farm House - 3-B South Interior Elevation

The Raymond Farm Center for Living Arts and Design

6370 Pidcock Creek Road New Hope, PA Spring 2018

Infrared Thermography

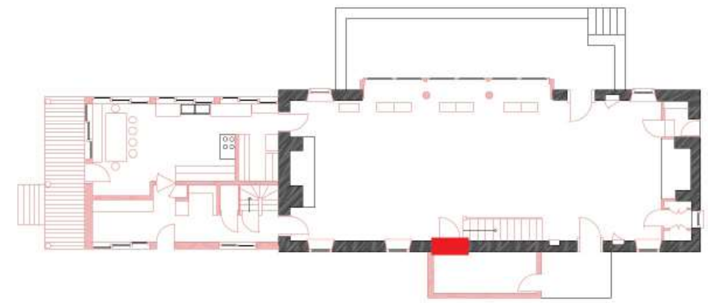
Recorded and Prepared by Sara Gdula

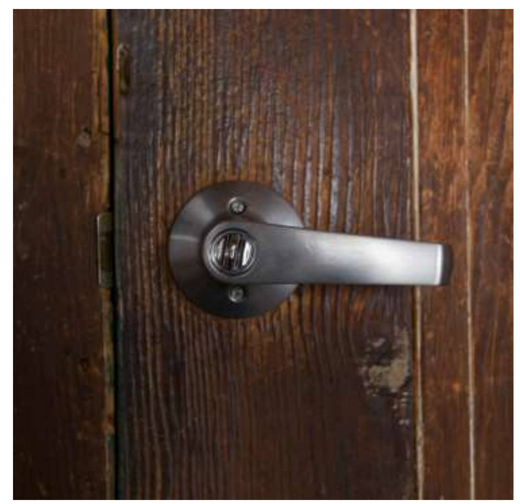
University of Pennsylvania

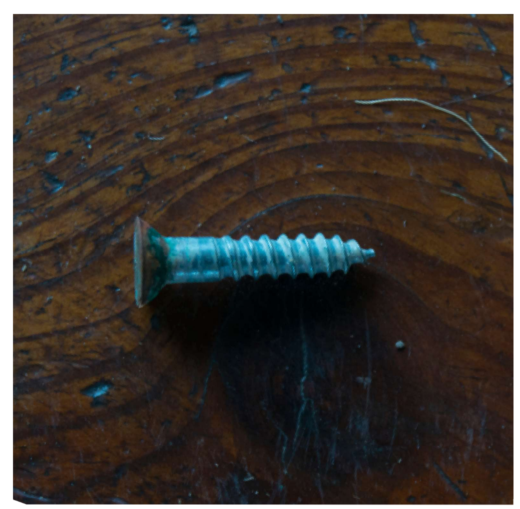
Graduate Program in Historic Preservation

Appendix F: Door Typology

Created by: Sara Gdula







Hardware: Modern knob	Moulding: Ogee Applied Moulding	Notes: Modern interventions on the exterior side of the transom. (not pictured). Door matches style of two other first-floor doors. on north and south elevations. Two extracted screws show post-1846 gimlet points. Door was likely rehung during Raymond campaign.
Fasteners: Modern Gimlet Screw	Proposed Origin Dates: 1850s Van Sandt Campaign	

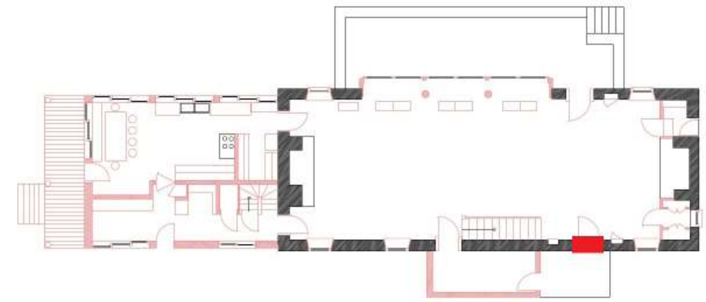
Sheet #
D1.1

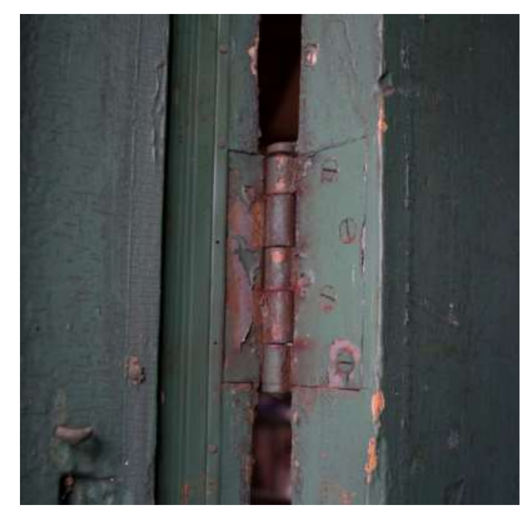
Farm House - 1-A Front Door

Door Typology
Recorded and Prepared by
Sara Gdula

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

University of Pennsylvania
Graduate Program in Historic Preservation





Hardware: Modern twist knob	Moulding: Ogee and Fillet Applied Moulding	Notes: Hinges partially blocked by modern features used to rehang door and implement modern storm door. Elongated hexagonal shape on exterior is the same as other main door on north facade. Modern screws and handle.
Fasteners: Post1846 gimlet screw	Proposed Origin Dates: 1850s Van Sandt campaign	

Sheet #

D1.2

Farm House - 1-A North Door

The Raymond Farm Center for Living Arts and Design

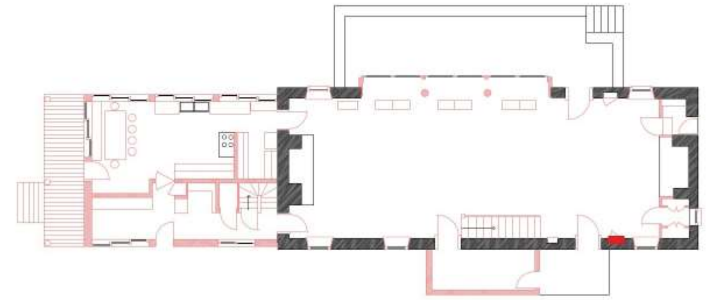
6370 Pidcock Creek Road New Hope, PA Spring 2018

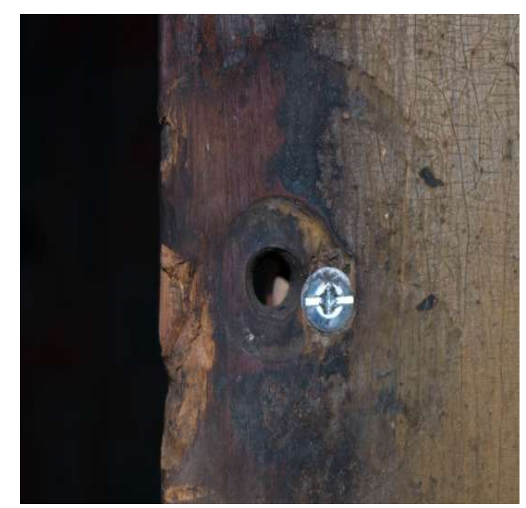
Door Typology

Recorded and Prepared by Sara Gdula

University of Pennsylvania

Graduate Program in Historic Preservation





Hardware:	Wooden pull knob Twist latch same as those found in third story windows.	Moulding:	Ogee, double bead and Fillet Edge Moulding	Notes:	Unit emedded into the surrounding masonry. Fasteners in the hinge were unable to be extracted. Exterior seemingly stripped of paint, however some finishes still extant in recesses of mouldings. Interior painted with pale olive green finish.
Fasteners:	Screws in the hinge unable to be extracted. Modern bolt fastening pull knob to door.	Proposed Origin Dates:	1780s Ross campaign		

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

University of Pennsylvania
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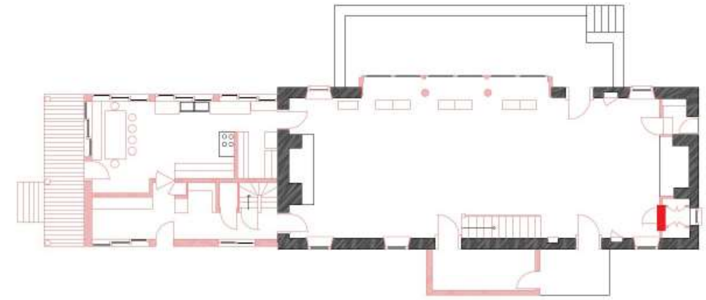
Door Typology
Recorded and Prepared by
Sara Gdula

Farm House - 1-A North Niche Door

Sheet #
D1.3



Hardware:	Moulding:	Notes:
Fasteners:	Proposed Origin Dates:	

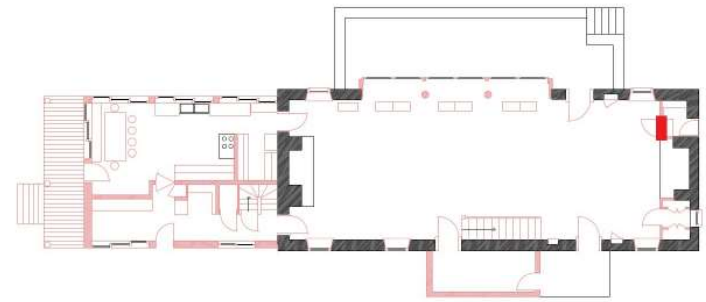
Sheet #
D1.4

Farm House - 1-A West Door North

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road
New Hope, PA
Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation



Hardware:	Moulding:	Notes:
Fasteners:	Proposed Origin Dates:	

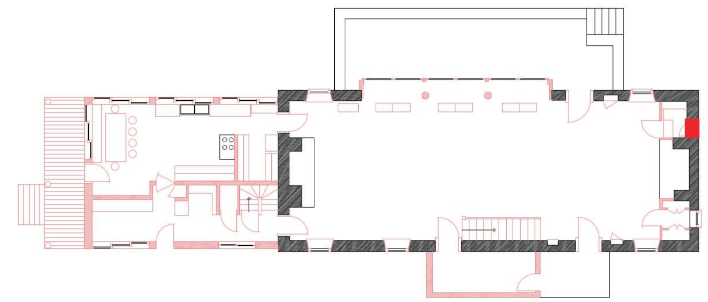
Sheet #
D1.5

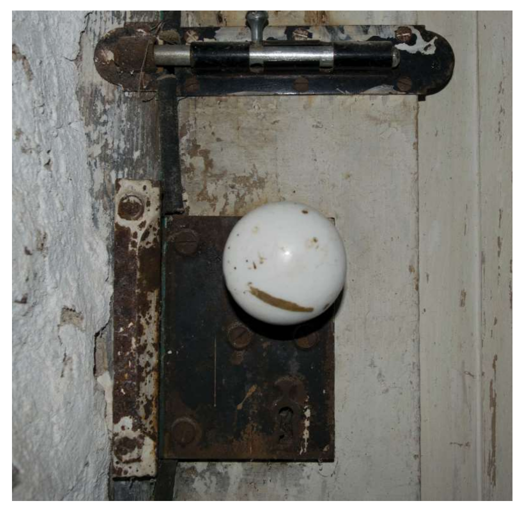
Farm House - 1-A West Door South

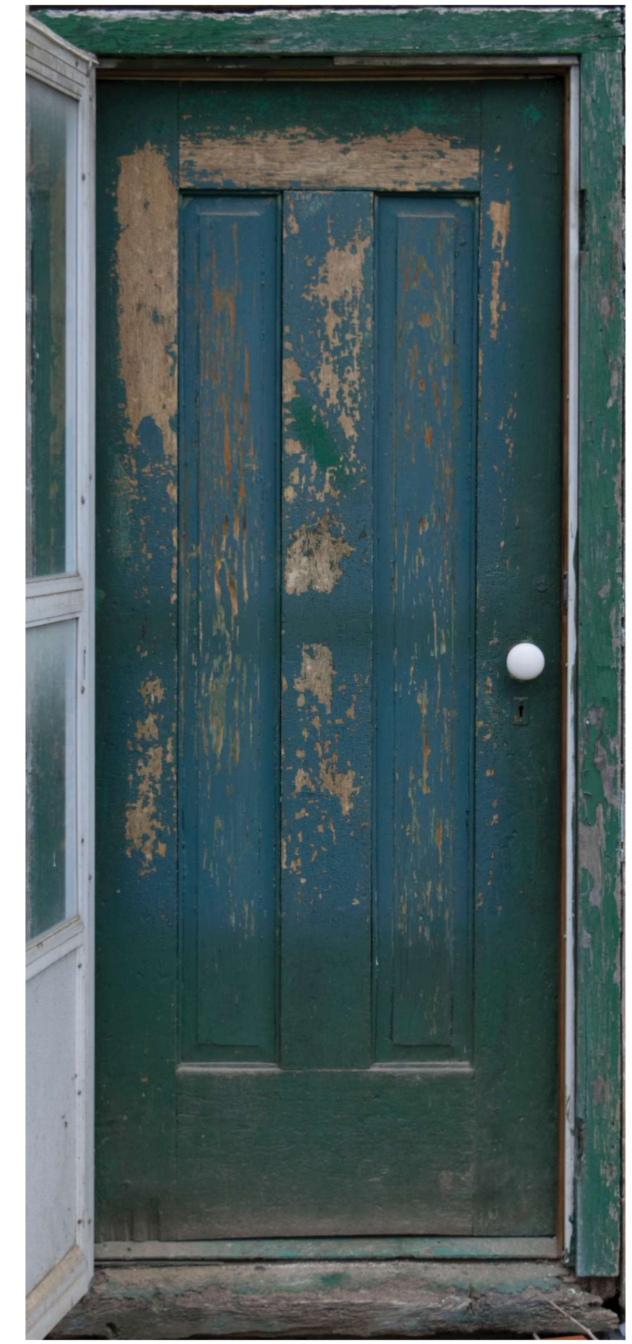
The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation







Hardware:	Moulding:	Notes:
Fasteners:	Proposed Origin Dates:	

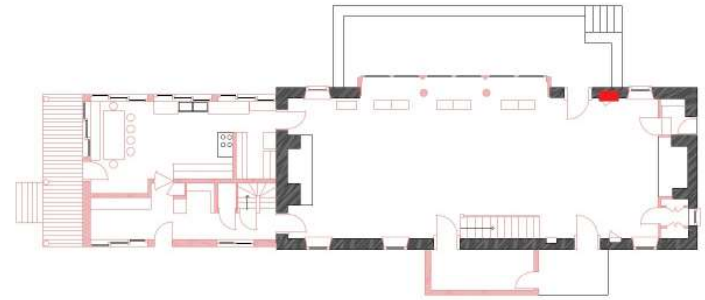
Sheet #
D1.6

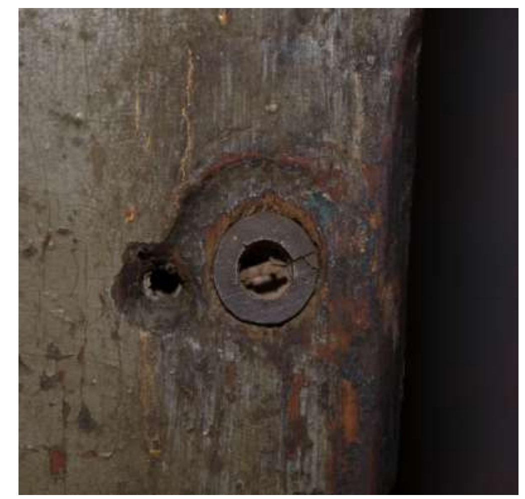
Farm House - 1-A West Door to Exterior

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation





Hardware: Wooden Pull Knob	Moulding: Ogee, double bead and Fillet Edge Moulding	Notes: Unit emedded into the surrounding masonry. Fasteners in the hinge were unable to be extracted. Exterior seemingly stripped of paint, interior painted with pale olive green finish.
Fasteners: Screws in hinge unable to be extracted	Proposed Origin Dates: 1780 Ross Campaign	

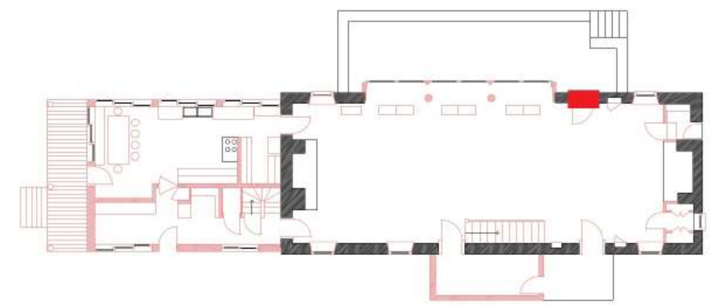
Sheet #
D1.7

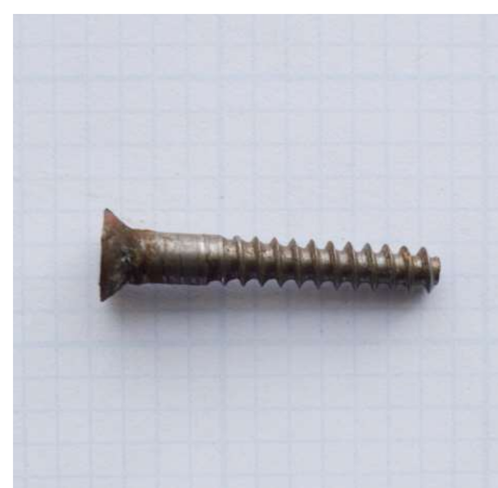
Farm House - 1-A South Niche Door

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation





Hardware:	Modern twist knob	Moulding:	Ogee Applied Moulding	Notes: Detached applied moulding temporarily removed for analysis. Finishing nails correspond to the type popularly used in the 1830s-mid 1840s but used here due to remote location. Moulding has a smooth finished back, indicating machine manufacture rather than hand-planing. Current knob set in ghost of previous hardware.
Fasteners:	Pointless Machine-Headed Screw	Proposed Origin Dates:	1850s Van Sandt Campaign	

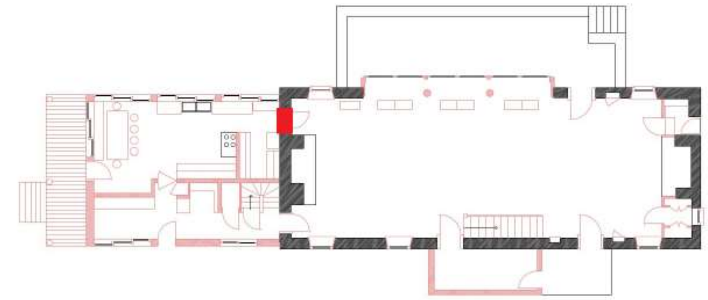
Sheet #
D1.8

Farm House - 1-A South Door

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation



Hardware:	Modern Reproduction thumb lift	Moulding:	Ogee and Fillet Edge Moulding	Notes:	Scar of previous hardware on opposite side of current handle. Addition to the bottom rail to make door match penetration height. Major checking in top left panel on living room side, creating large crack.
Fasteners:	Post1846 gimlet screw	Proposed Origin Dates:	Colonial (Scavenged)		

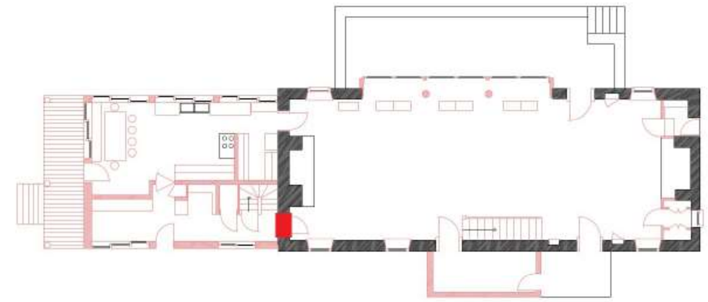
Sheet #
D1.9

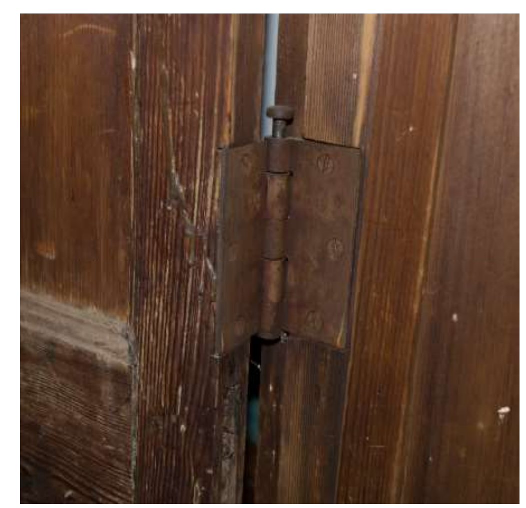
Farm House -1-A East Elevation South Door

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation





Hardware: Modern Reproduction thumb lift	Moulding: Ogee and Fillet Edge Moulding	Notes: Scar of previous hardware on opposite side of current handle. Addition to the bottom rail to make door match penetration height. Major checking in top left panel on living room side, creating large crack.
Fasteners: Post1846 gimlet screw	Proposed Origin Dates: Colonial (Scavenged)	

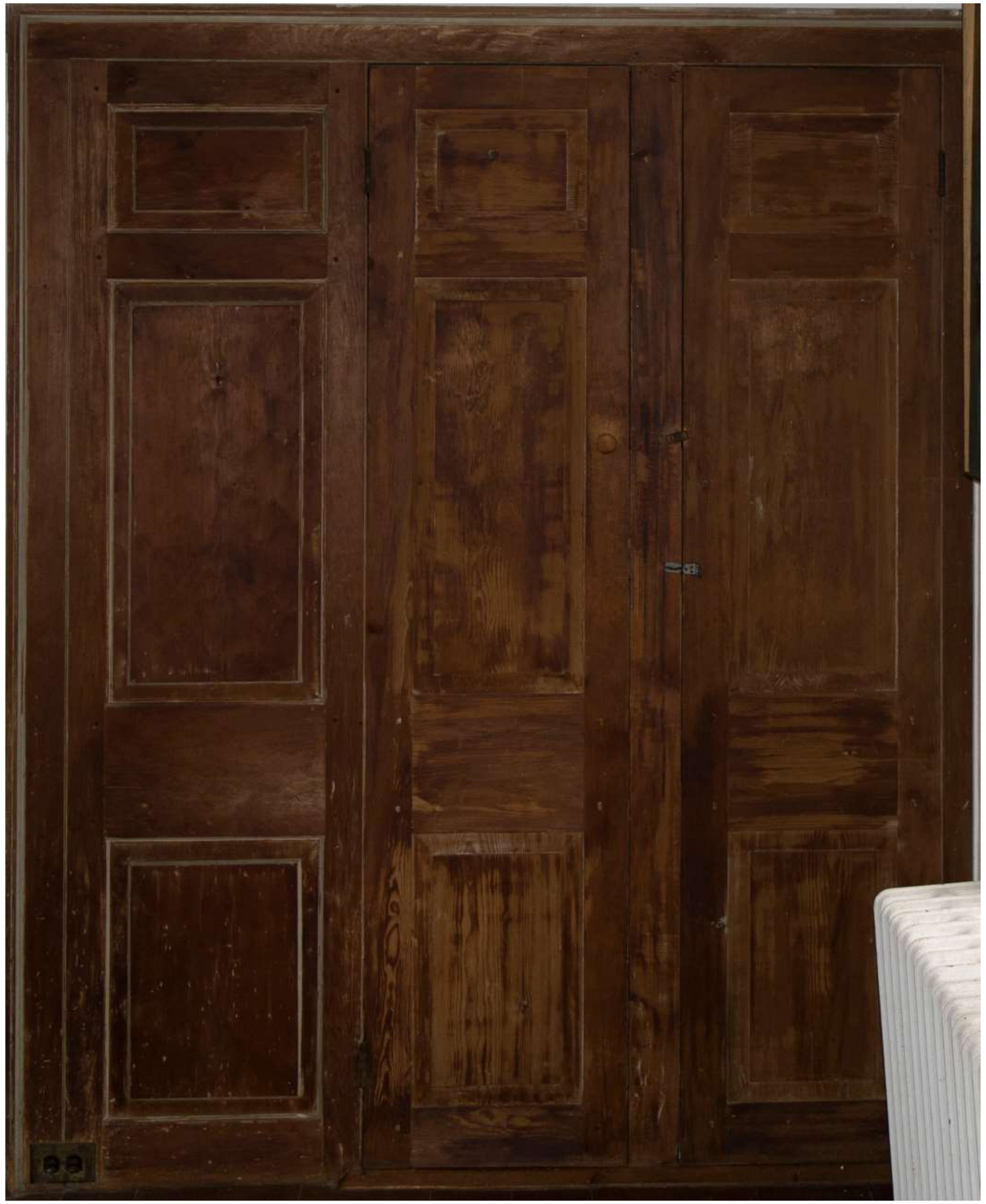
The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

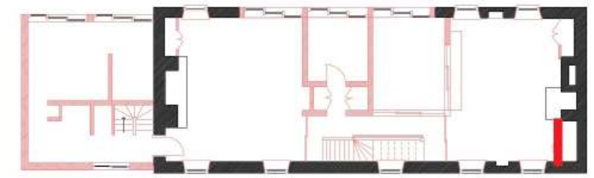
University of Pennsylvania
Graduate Program in Historic Preservation

Door Typology
Recorded and Prepared by
Sara Gdula

Farm House - 1-A East Elevation North Door

Sheet #
D1.10





Hardware:	Wooden pull knob Cast Iron Butt Hinge	Moulding:	Ogee, double bead and Fillet Edge Moulding	Notes:	Unit embedded into masonry. One immovable panel flanks the two moveable closet doors to the left.
Fasteners:	Screws not extracted	Proposed Origin Dates:	1780s Ross campaign		

Sheet #
D2.1

Farm House -2-A West Elevation North Door

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
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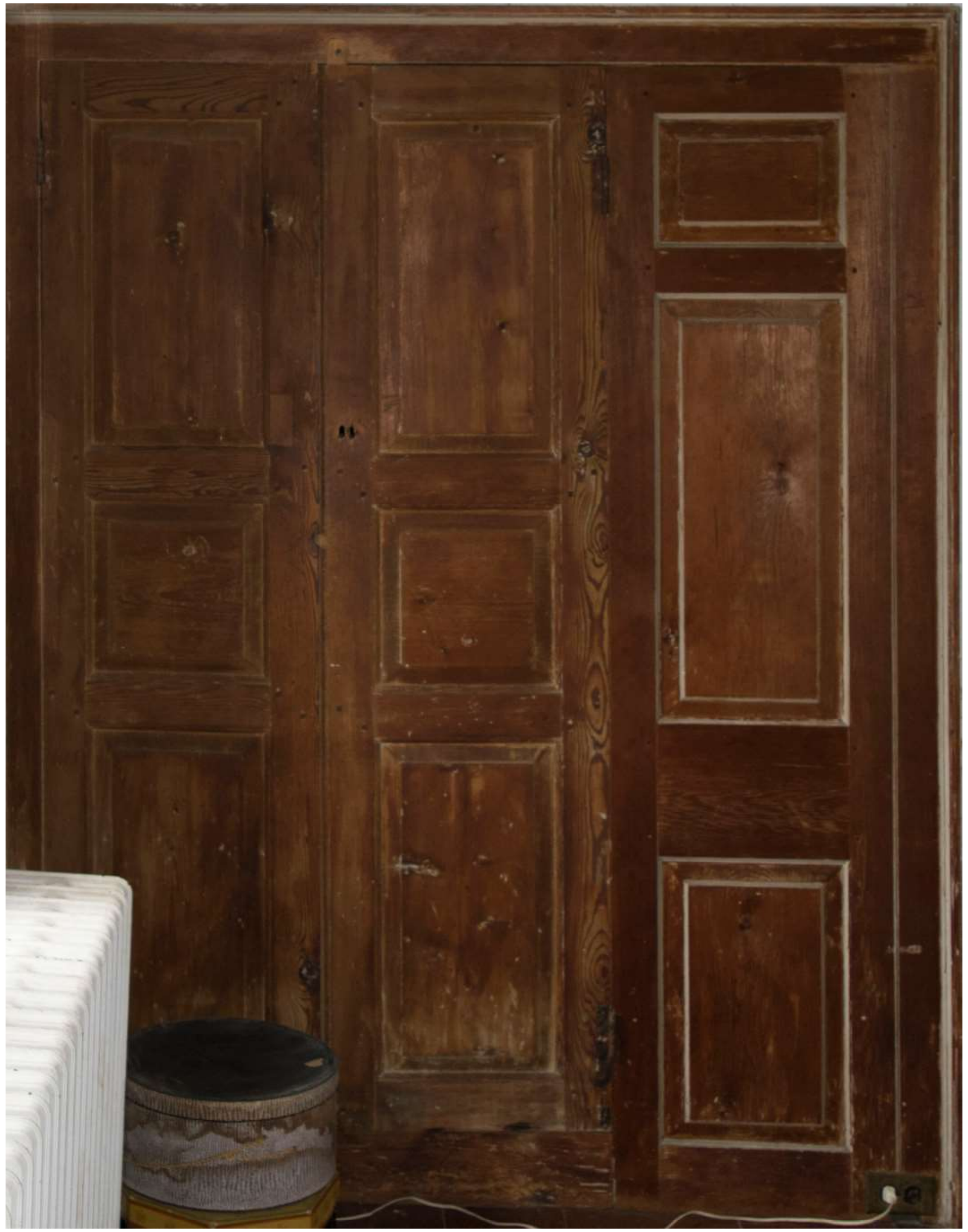
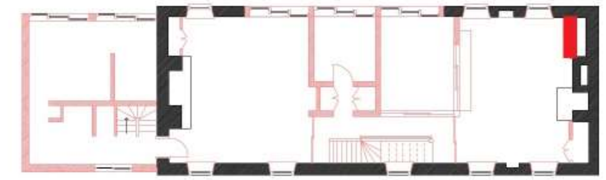
Graduate Program in Historic Preservation





Hardware:	No knob Cast Iron Butt Hinge	Moulding:	Ogee, double bead and Fillet Edge Moulding	Notes:	Unit embedded into masonry. One immovable panel flanks the two moveable closet doors to the right.
Fasteners:	Screws not extracted	Proposed Origin Dates:	1780s Ross campaign		

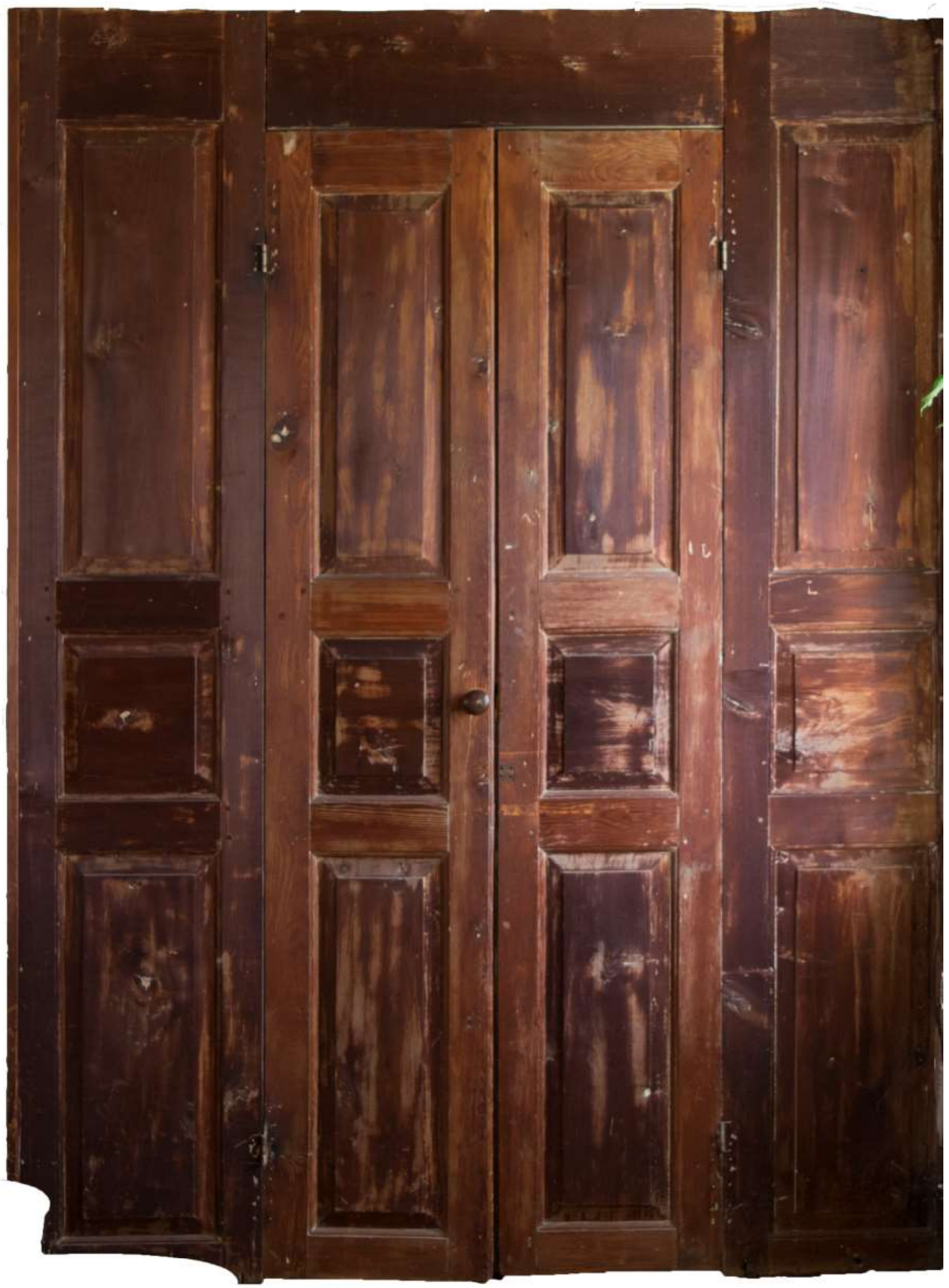
Sheet #
D2.2

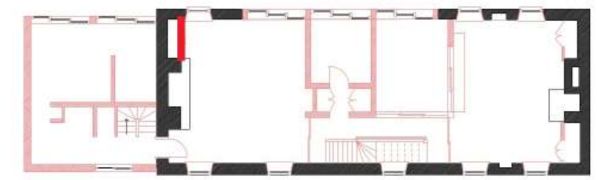
Farm House - 2-A West Elevation South Door

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation





Hardware: Wooden twist knob	Moulding: Ogee, double bead and Fillet Edge Moulding
Fasteners: Screws not extracted	Proposed Origin Dates: 1780s Ross campaign

Notes: Unit embedded into masonry. Two immovable panels flank the two moveable closet doors.

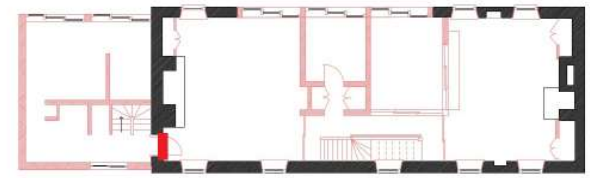
Sheet # D2.3

Farm House - 2-B East Elevation South Door

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018



Hardware: Modern Reproduction Thumb Latch Cast Butt Hinge	Moulding: Roman Ovolo Edge Moulded	Notes: Wood members likely Colonial, moved to current location during Raymond campaign. Scarring from previous hardware present. Extension on bottom rail to fit the portal. Mostly stripped of paint, white remnants on panel moulding.
Fasteners: Modern Gimlet Screws	Proposed Origin Dates:	

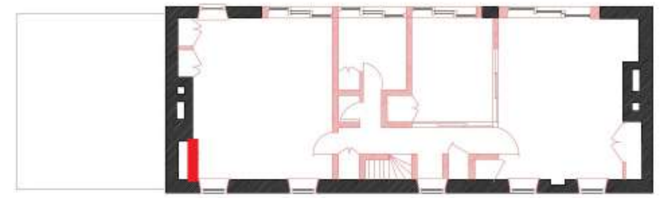
Sheet #
D2.4

Farm House - 2-B East Elevation North Door

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road
New Hope, PA
Spring 2018



Hardware: Embedded pull handle Cast Iron Butt Hinge	Moulding: None
Fasteners: Modern Gimlet Screws	Proposed Origin Dates: 1939 Raymond

Notes: Plywood door finished with cedar veneer. Likely constructed on-site.

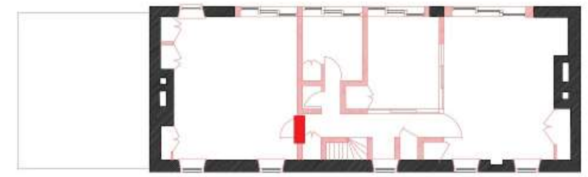
Sheet # D3.2

Farm House - 3-B East Elevation North Door

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018



Hardware: Modern reproduction thumb lift Cast Iron Butt Hinges	Moulding: None
Fasteners: Modern Gimlet Screws	Proposed Origin Dates: Colonial (Scavenged)

Notes:

Sheet #
D3.1

Farm House - 3-B West Elevation Door

The Raymond Farm Center for Living Arts and Design
6370 Pidcock Creek Road New Hope, PA Spring 2018

Door Typology
Recorded and Prepared by
Sara Gdula

University of Pennsylvania
Graduate Program in Historic Preservation

Appendix G: Previous Student Work on Raymond Farm

Completed During the Course of the HSPV Architectural Wood Seminar, Fall 2017

Basement Joist Milling Technology Mapping

Created by: John Giganti

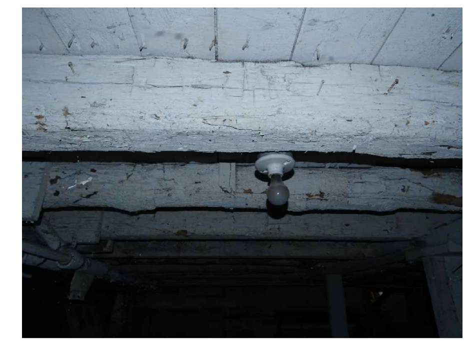
Exterior Wood Condition Assessment and Recommendations

Created by: Alberto Calderón-González, Anthony Hita

BASEMENT REFLECTED CEILING DIAGRAM

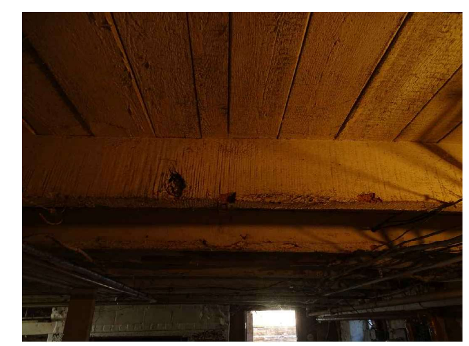
EXAMPLE OF A HAND HEWN JOIST (LEFT) AND TWO UNHEWN JOISTS WITH BARK (RIGHT)

PIT SAWN LUMBER

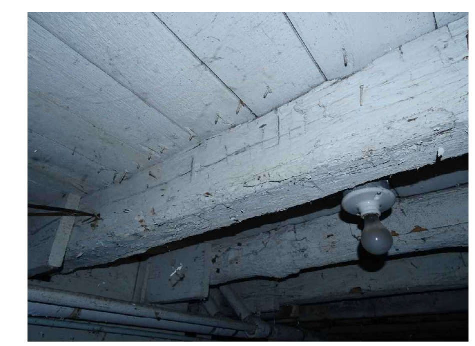


JOIST HEWN WITH A BROAD AXE

HEWN JOIST



WATER MILL SAWN JOIST



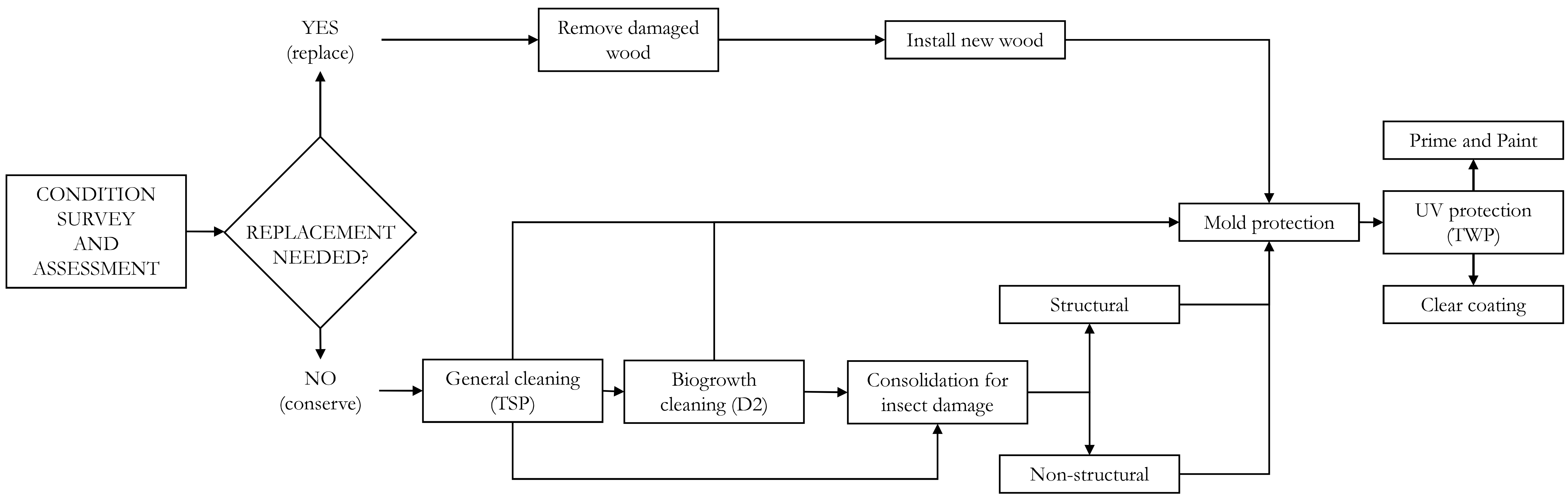
JOIST HEWN WITH A BROAD AXE

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Reflected Ceiling Diagram and Joist Typology

Not to scale


CONDITION SURVEY AND ASSESSMENT
REPLACEMENT NEEDED?
YES (replace)
Remove damaged wood
Install new wood
NO (conserve)
General cleaning (TSP)
Biogrowth cleaning (D2)
Consolidation for insect damage
Structural
Non-structural
Mold protection
UV protection (TWP)
Prime and Paint
Clear coating

North elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Conditions Survey: Conditions Glossary
Alberto Calderón-González, Anthony Hita
Plan 1 of 3: North Elevation 1:75
0 15ft

Legend

- Dimensional loss
- Brown rot, visible
- Brown rot, internal
- Biological growth
- UV damage: minor
- UV damage: moderate
- UV damage: severe
- Repairs or replacements
- Finishes failure
- Insect infestation
- Moisture content: above/below 15%
- Wood softness

Notes

1. No survey of wood rot above A-A' line

South elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Conditions Survey: Conditions Glossary
Alberto Calderón-González, Anthony Hita
Plan 2 of 3: South Elevation 1:75
0 15ft

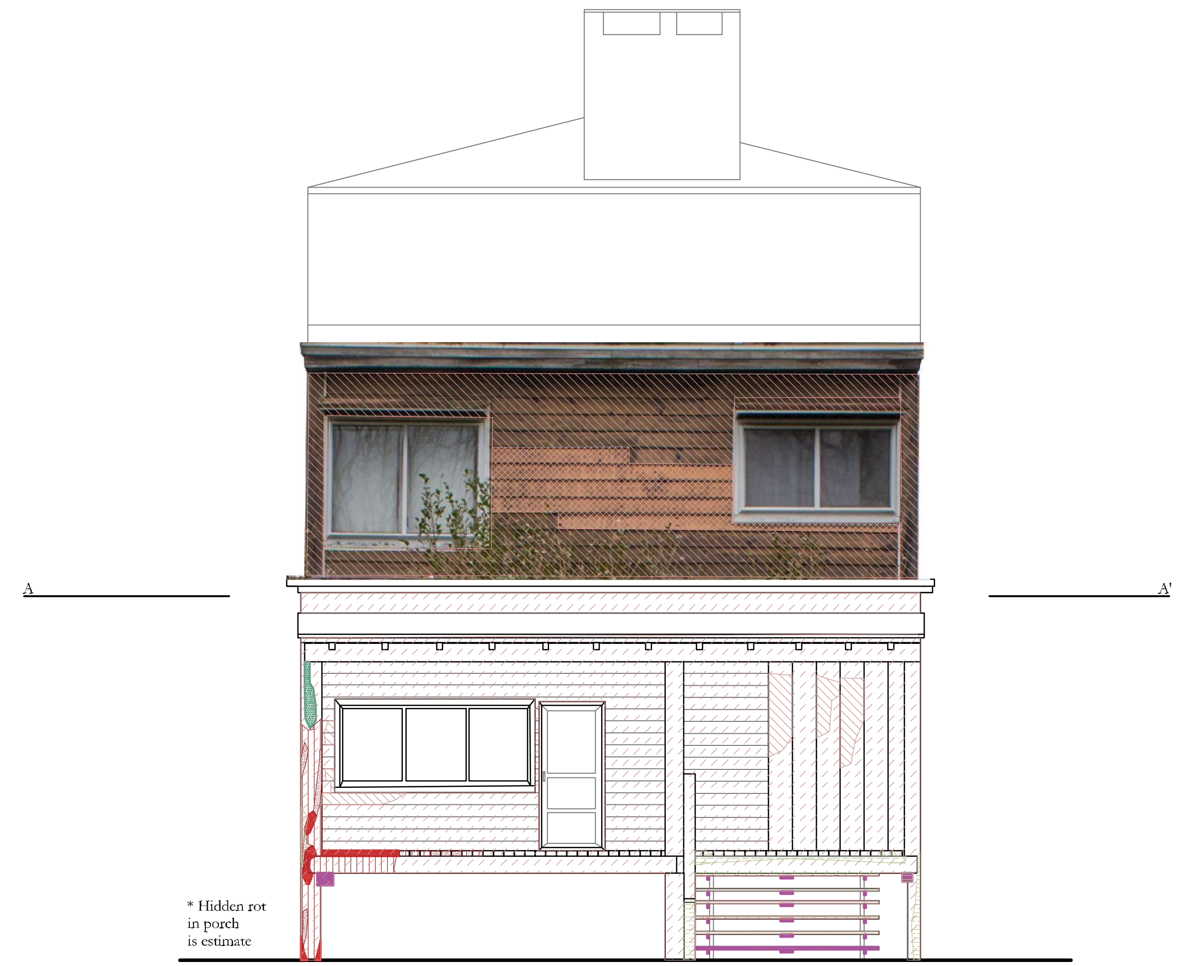
Legend

- Dimensional loss
- Brown rot, visible
- Brown rot, internal
- Biological growth
- UV damage: minor
- UV damage: moderate
- UV damage: severe
- Repairs or replacements
- Finishes failure
- Insect infestation
- Moisture content: above/below 15%
- Wood softness

Notes

1. No survey of wood rot above A-A' line

West elevation



East elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Conditions Survey: Conditions Glossary

Alberto Calderón-González, Anthony Hita

Plan 3 of 3: East and West Elevations 1:75

0 15ft

Legend

- Dimensional loss
- Brown rot, visible
- Brown rot, internal
- Biological growth
- UV damage: minor
- UV damage: moderate
- UV damage: severe
- Repairs or replacements
- Finishes failure
- Insect infestation
- Moisture content: above/below 15%
- Wood softness

Notes

1. No survey of wood rot above A-A' line

North elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Wood Replacement

Alberto Calderón-González, Anthony Hita

Plan 1 of 3: North Elevation 1:75

0 15ft

Legend

Complete replacement (Douglas fir)

Dutchman replacement (Douglas fir)

Complete replacement (cedar)

Dutchman replacement (cedar)

Notes

1. Replacement of parts of frames in second and third floors due to brown rot to be confirmed pending testing.
2. For procedure for replacements and Dutchmen see text of report.

South elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Wood Replacement

Alberto Calderón-González, Anthony Hita

Plan 2 of 3: South Elevation 1:75

0 15ft

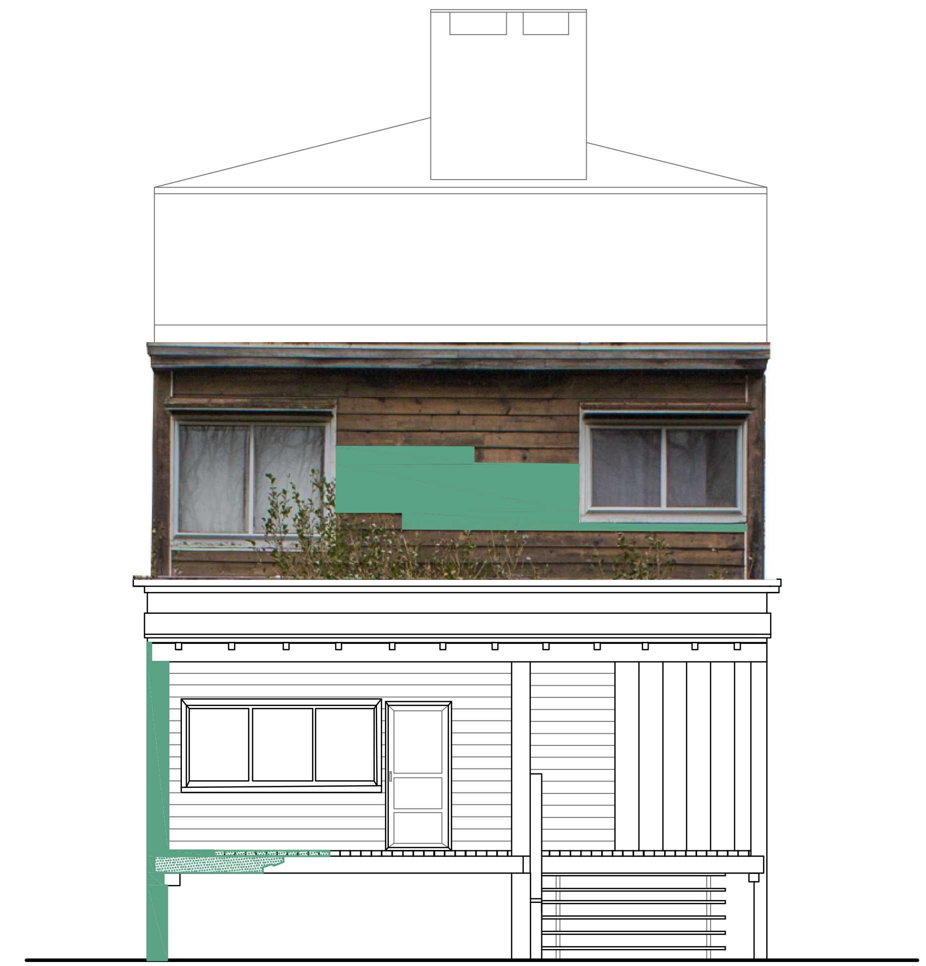
Legend

- Complete replacement (Douglas fir)
- Dutchman replacement (Douglas fir)
- Complete replacement (cedar)
- Dutchman replacement (cedar)

Notes

1. Replacement of parts of frames in second and third floors due to brown rot to be confirmed pending testing.
2. For procedure for replacements and Dutchmen see text of report.

West elevation



East elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Wood Replacement

Alberto Calderón-González, Anthony Hita

Plan 3 of 3: East and West Elevations 1:75

0 15ft

Legend

- Complete replacement (Douglas fir)
- Dutchman replacement (Douglas fir)
- Complete replacement (cedar)
- Dutchman replacement (cedar)

Notes

1. Replacement of parts of frames in second and third floors due to brown rot to be confirmed pending testing.
2. For procedure for replacements and Dutchmen see text of report.

North elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938
Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Surface Cleaning
Alberto Calderón-González, Anthony Hita
Plan 1 of 3: North Elevation 1:75
0 15ft

Legend

Biogrowth cleaning

Notes

1. All wood surfaces to undergo general cleaning initially. Then proceed with biogrowth cleaning for areas indicated.
2. Treatment products as indicated in text of report.

South elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938
Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Surface Cleaning
Alberto Calderón-González, Anthony Hita
Plan 2 of 3: South Elevation 1:75
0 15ft

Legend

Biogrowth cleaning

Notes

1. All wood surfaces to undergo general cleaning initially. Then proceed with biogrowth cleaning for areas indicated.
2. Treatment products as indicated in text of report.

West elevation

East elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938
Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Surface Cleaning
Alberto Calderón-González, Anthony Hita
Plan 3 of 3: East and West Elevations 1:75
0 15ft

Legend

Biogrowth cleaning

Notes

1. All wood surfaces to undergo general cleaning initially. Then proceed with biogrowth cleaning for areas indicated.
2. Treatment products as indicated in text of report.

North elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938
Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Wood Consolidation
Alberto Calderón-González, Anthony Hita
Plan 1 of 3: North Elevation 1:75
0 15ft

Legend

Structural consolidation
Non-structural consolidation

Notes

1. Treatment products and consolidation procedures as indicated in text of report.

South elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Wood Consolidation

Alberto Calderón-González, Anthony Hita

Plan 2 of 3: South Elevation 1:75

0 15ft

Legend

Structural consolidation

Non-structural consolidation

Notes

1. Treatment products and consolidation procedures as indicated in text of report.

West elevation

East elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Wood Consolidation

Alberto Calderón-González, Anthony Hita

Plan 3 of 3: East and West Elevations 1:75

0 15ft

Legend

Structural consolidation

Non-structural consolidation

Notes

1. Treatment products and consolidation procedures as indicated in text of report.

North elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938
Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Surface Coatings
Alberto Calderón-González, Anthony Hita
Plan 1 of 3: North Elevation 1:75
0 15ft

Legend

UV-resistant prime + paint
UV-resistant clear coating

Notes

1. Before applying any coating on painted members strip existing paint. Leave representative probes (c. 2% of surface) in each window unstripped as a record of paint layers.
2. Apply biocide solution on all wood before applying any other coatings.
3. Treatment products and consolidation procedures as indicated in text of report.
4. Paint color TBD by conservator after historical and sample research.

South elevation

Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938

Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Surface Coatings

Alberto Calderón-González, Anthony Hita

Plan 2 of 3: South Elevation 1:75

0 15ft

Legend

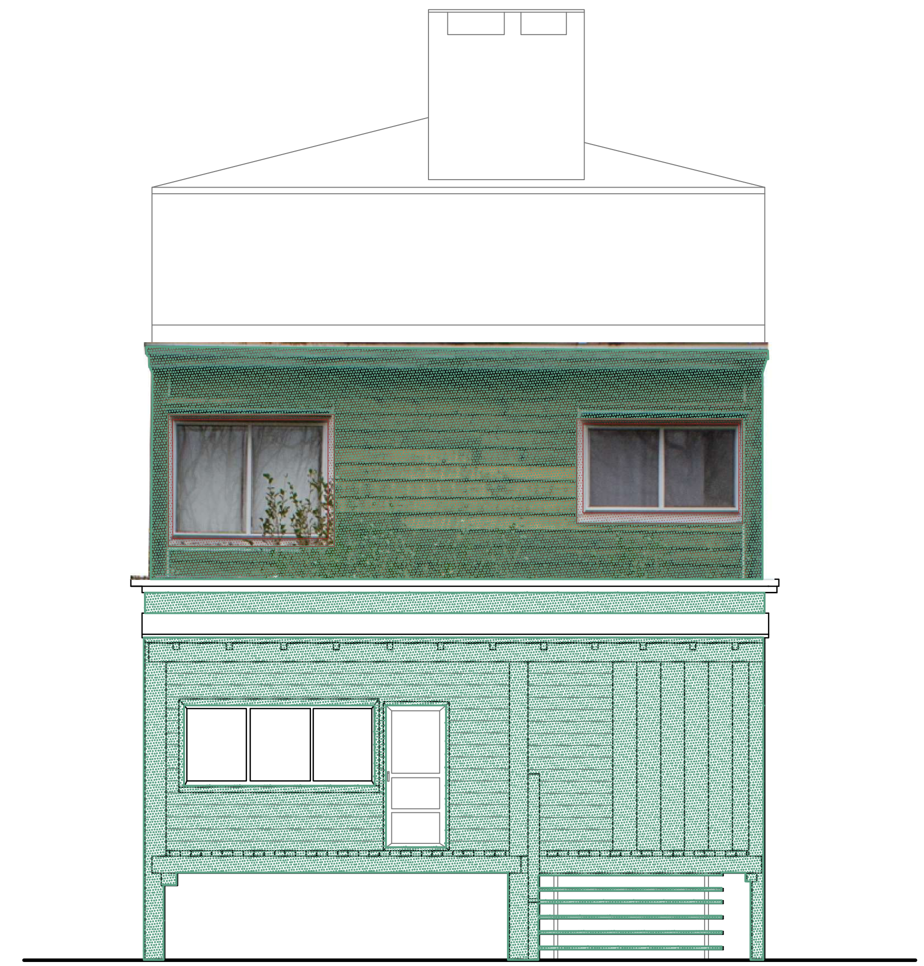
UV-resistant prime + paint

UV-resistant clear coating

Notes

1. Before applying any coating on painted members strip existing paint. Leave representative probes (c. 2% of surface) in each window unstripped as a record of paint layers.
2. Apply biocide solution on all wood before applying any other coatings.
3. Treatment products and consolidation procedures as indicated in text of report.
4. Paint color TBD by conservator after historical and sample research.

West elevation



East elevation

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Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Exterior Treatment Recommendations: Surface Coatings
Alberto Calderón-González, Anthony Hita
Plan 3 of 3: East and West Elevations 1:75
0 15ft

Legend

UV-resistant prime + paint
UV-resistant clear coating

Notes

1. Before applying any coating on painted members strip existing paint. Leave representative probes (c. 2% of surface) in each window unstripped as a record of paint layers.
2. Apply biocide solution on all wood before applying any other coatings.
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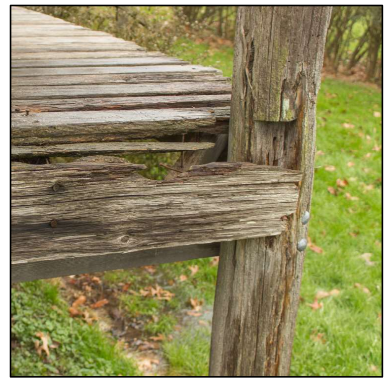
Exterior Conditions Survey: Conditions Glossary
Alberto Calderón-González, Anthony Hita
Page 1 of 3

Condition: Dimensional loss

Definition: Loss of volume of wood greater than 1/4" deep, regardless of cause. Common causes are rot and spalling.

Graphic:

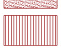


Condition: Brown rot

Definition: Fungal infestation causing digestion of cellulose (especially in softwoods) and therefore loss of mechanical properties and density, increase in moisture content, and dimensional loss. (a) visible, (b) internal. Internal brown rot surveyed only for first floor.

Graphic:


(a)


(b)


(a)


(b)

Condition: Biological growth

Definition: Visible biological growth on the surface of the wood. Examples include algae and lichens.

Graphic:

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Exterior Conditions Survey: Conditions Glossary
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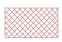
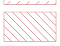
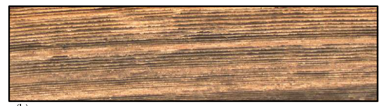
Condition: Ultraviolet damage

Definition: Degradation of cellulose due to UV radiation, causing discoloration, surface loss and raised relief of latewood. (a) Minor: surface wood decayed. (b) Moderate: surface wood heavily decayed, new wood partially exposed. (c) Severe: surface wood destroyed, new wood exposed underneath.
Graphic:

 (a)  (c)
 (b)


(a)

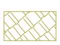

(b)


(c)

Condition: Finishes failure

Definition: Degradation or adhesion failure of surface finishes exposing wood underneath.

Graphic:



Condition: Repairs or replacements

Definition: Non-historic wood elements introduced to replace damaged or removed wood. Does not include elements added due to a change in design, e.g. the Raymonds' additions

Graphic:

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Exterior Conditions Survey: Conditions Glossary

Alberto Calderón-González, Anthony Hita

Condition: Insect infestation

Definition: Infestation by wood-destroying insects causing loss of wooden material.

Graphic:

Condition: Moisture content

Definition: Moisture reading using a MMC 210 moisture meter calibrated for a specific gravity of 0.35. The moisture reading accounts for a depth of 3/4" and is only slightly affected by weather conditions. (a) Moisture above 15%. (b) Moisture below 14.99%

Graphic:

28.75 (a)

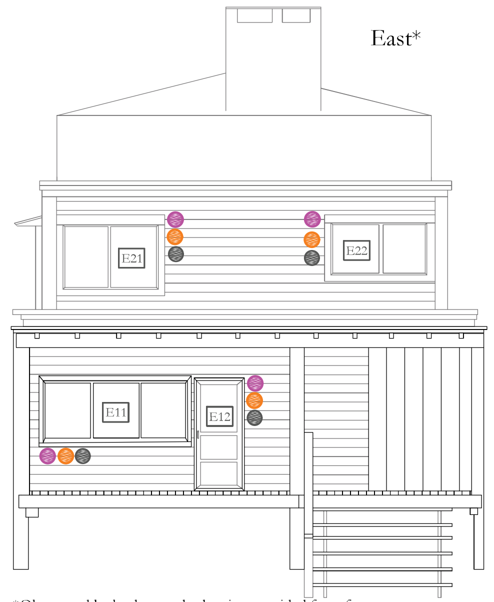
8.75 (b)

Condition: Wood softness

Definition: Lack of resistance of the wood to penetration with a Malco A0 steel awl. Typically indicates wood rot.

Graphic:

East*



*Obstructed by bush growth, drawing provided for reference.

North

West

South

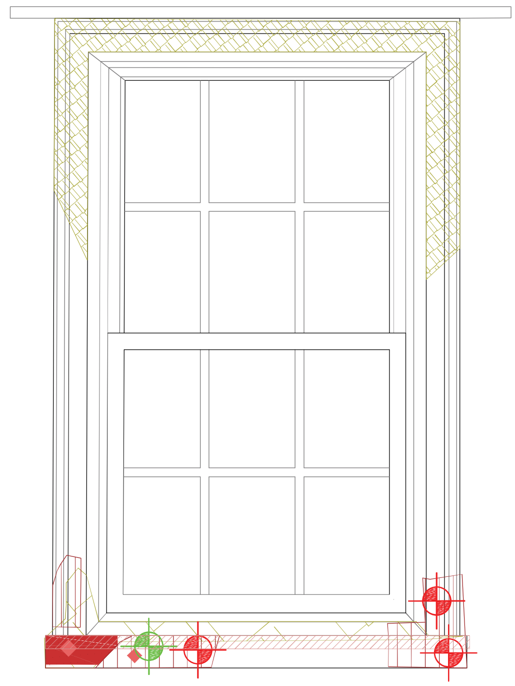
Raymond Farm Center 6370 Pidcock Creek Rd, New Hope, PA 18938
Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Opening Typology
Alberto Calderón-González, Anthony Hita

*Not to scale, some elements enlarged to show detail

Opening Typology
Legend

- Removed Opening (Historic)
- Douglas Fir Surround (Probable)
- Surround Decorative Finish (Paint)
- Historic Opening (Pre-Raymond)
- Cedar Surround (Probable)
- Surround Unfinished or Clear Coated
- Modern Opening (Raymond)



Raymond Farm Center

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Alberto Calderón-González, Sara Gdula, John Giganti, Anthony Hita

Window Detail
Alberto Calderón-González, Anthony Hita

*Not to scale, elements enlarged to show detail

Typical Window Showing Typical Conditions
Legend

- Dimensional loss
- Brown rot, visible
- Brown rot, internal
- Finishes failure
- UV damage: moderate
- Moisture content: above/below 15%
- Wood softness

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