

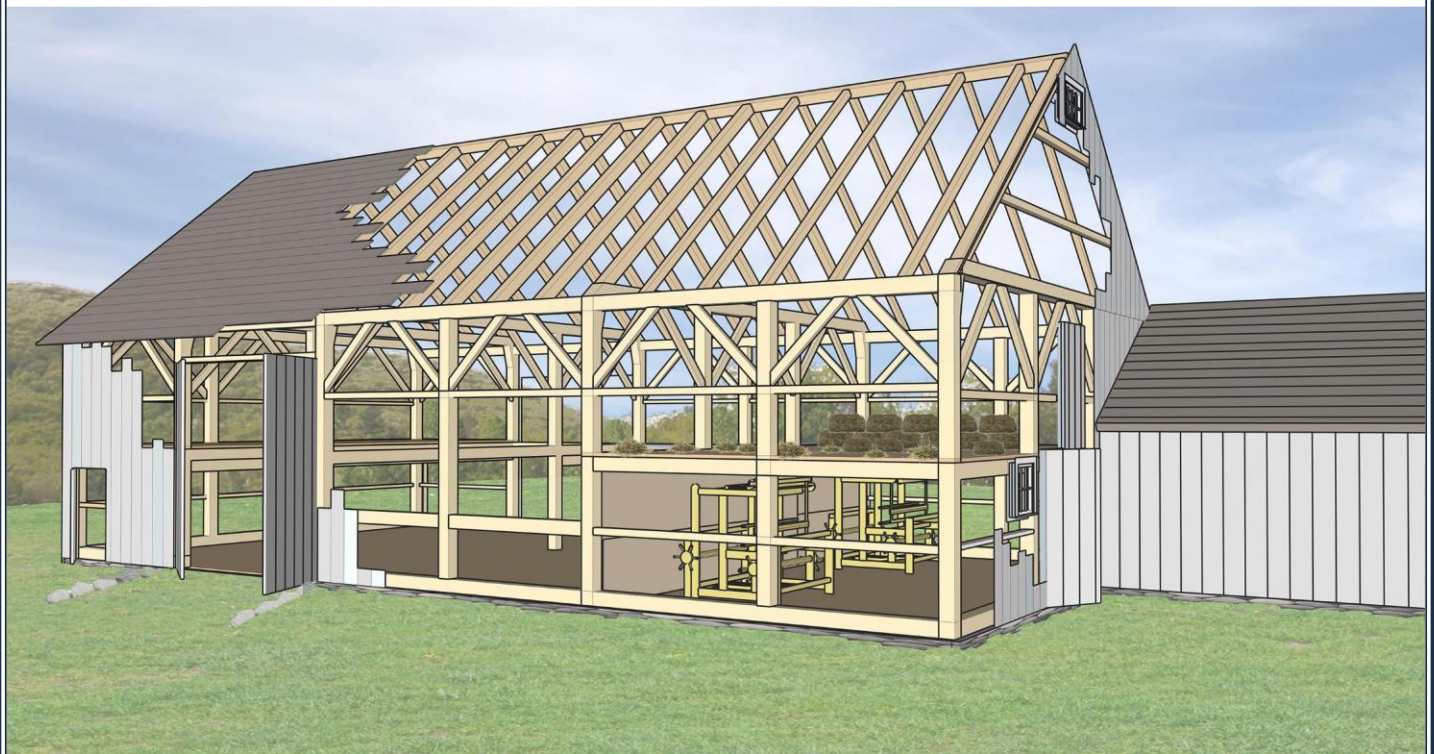
Buckland Historical Society

19-100

Buckland, MA 01338

Architectural Restoration and Educational Resource Plan

For an English Style Barn
at the Wilder Homestead Property



FUNDED BY:



The Massachusetts Cultural Council

10 ST. JAMES STREET, 3RD FLOOR, BOSTON, MA02116-3803

SUBMITTED BY:



Stevens & Associates, p.c.

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SECTION 1

Barn Description

The Wilder Homestead, located in Buckland, Massachusetts, is owned by the Buckland Historical Society, and is a National Landmarks Historic Site. The Wilder Homestead Barn, circa 1798, is one of the few surviving English style barns located on a colonial era farm. The Massachusetts Cultural Council has funded this feasibility study, supporting the planning work necessary to restore the barn, support the mission of the historical society, and expand programming to the regional and broader community.

Three site visits and structural inspections were made to assess the condition of the barn, and to confirm the suitability of lifting the barn in place, to sit on cribbing during the construction of a proper foundation. Disassembly of the barn was considered, although later ruled out, when the structural integrity was determined sufficient to utilize the much less costly lifting in place approach. The lower 12 to 24 inches of the siding are deteriorated, where the lack of foundation leaves the boards touching the ground. Virtually all of the base plate timbers have been replaced, along with many of the lower portions of the posts. With a new concrete foundation, concealed by a fieldstone veneer, the sill plates will be out of the dirt and protected from rot.

The structural assessment report, along with the photographic survey, describe multiple deficiencies requiring attention. Existing heavy timber framing members will be repaired whenever possible. Hemlock harvested on site and milled at a local sawmill, will be utilized for replacement timbers. Traditional mortise and tendon joinery will be used where posts or beams are replaced. Temporary shoring now in place at the hayloft and an area of roof framing failure, when be replaced, with the original post and beam structure restored.

Maintaining the historical integrity of the barn will be a primary objective. Concurrently functional improvements and handicapped accessibility will be provided. The uneven asphalt floor will be replaced with wide pine planks, cut from trees on the Wilder homestead land. An earthen ramp will provide at grade access to the barn doors, and the threshing floor inside. A previously removed, second pair of barn doors will be installed directly opposite the doors to the north, at the opposite end of the threshing floor, restoring the barn to its original appearance, while providing handicapped accessibility. The animal stall style of doors, located at the entry to the weaving room and at the future kitchen addition, will be made accessible with removeable wooded ramps. A wood grab bar will be placed beside each entry door. This was an effective solution used at our previous colonial period barn restoration in Little Compton, RI. Accessibility was provided, while maintaining the historic character of the barn

Antique barn looms, similar to the ones used by Eleanor Wilder Clark and “The Buckland Weavers” will remain on display and in use at the weaving room. The framing at the ceiling of the weaving room will be raised slightly to increase ceiling height, and will be strengthened to support loads at the loft above. The loft framing floor, along with the walls of the weaving room, will be insulated and finished with barnboard. The stone pavers will be replaced with a wide plank pine floor, with heating ductwork concealed beneath the floor, extending the season for weaving. A storage closet will be added, and with the second phase of work, direct access to the kitchen and toilets will be provided.

The garage addition to the barn is beyond repair and will be demolished to make way for a new addition constructed in its place. This work will comprise the second phase of the project. The addition will approximately fit the footprint of the existing garage, with the same exterior barnboard siding, door with strap hinges, and slate roof. The intent will





Barn Project Description

be to maintain the character of the barn. The addition will house a catering kitchen and restrooms, enabling expanded uses for the barn. Two more windows, matching the existing wood hopper windows will be added at discrete locations, to bring more natural light into the weaving room. Similar windows will be used at the kitchen / restroom addition.

We met with the barn committee multiple times both in person and with video conferencing, as well as a meeting at the barn. Various potential new uses for the barn were discussed.

The decision was to provide more flexible spaces with amenities to support added uses. The primary current uses for weaving and the display of farm implements to continue. Due to limitations with the COVID-19 pandemic, I alone visited a similar colonial period barn restoration in Little Compton, Rhode Island. This was a project that we completed in 2002, and I returned to learn how successful the project had been and what they might have done differently. The project was a helpful comparison informing some of our decisions for this project.

Outline specifications for the barn restoration phase, and separately for the kitchen/restroom addition phase are included with this feasibility study. Along with the drawings, these documents informed the cost estimates, which were also broken out by phase. The cost estimates include a heating system, substantial plumbing and electrical upgrades, and a new septic system. The costs are based on today's prices, which are somewhat inflated due to shortages and the unique circumstances of the COVID-19 pandemic. The potential for volunteer services, and donated materials was discussed, although not considered in the cost estimates.

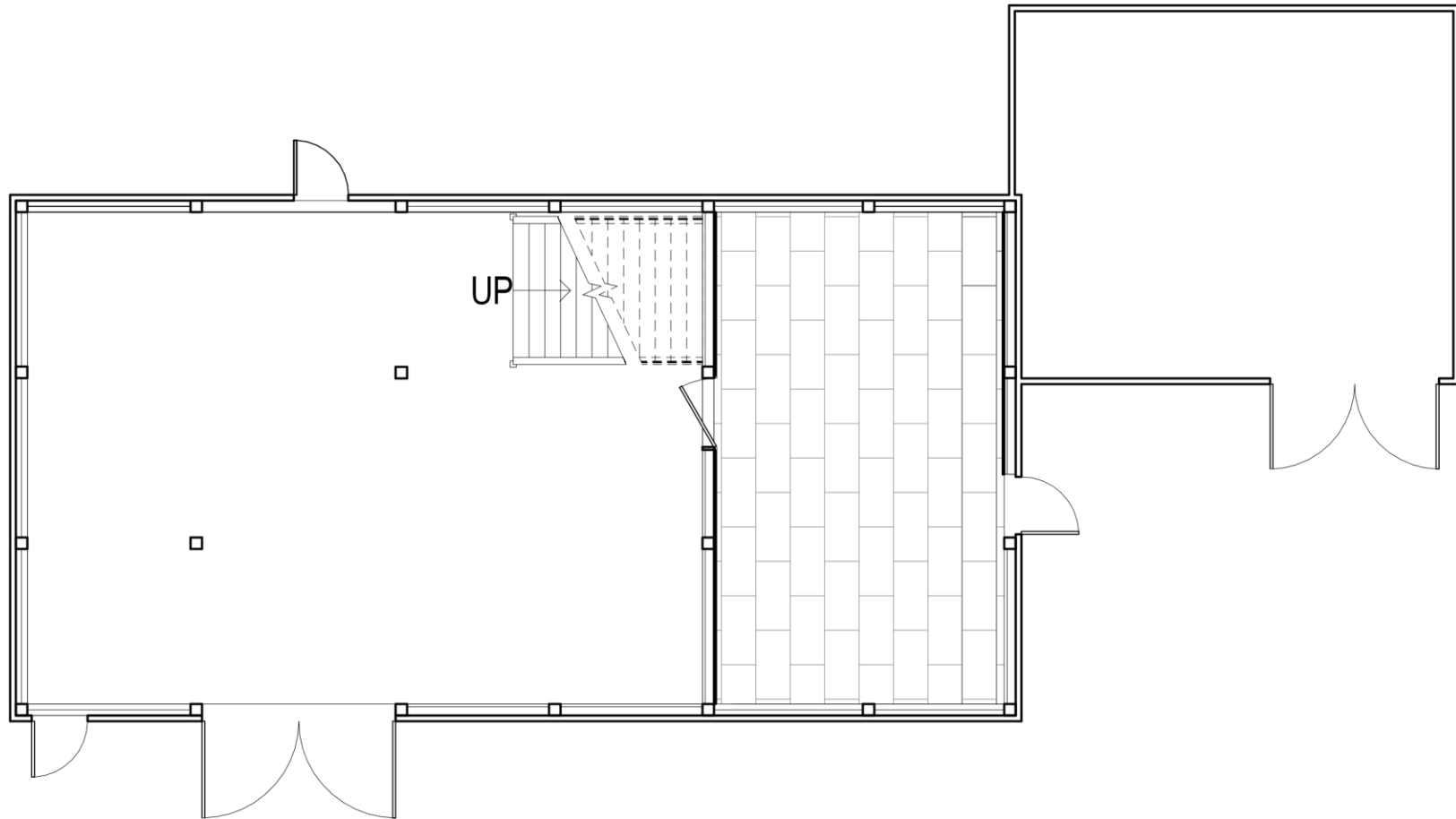
This feasibility study is the culmination for six months of collaboration between our team of architects and structural engineers at Stevens & Associates and the Buckland Historical Society Barn Committee. The conceptual design, material specifications, and cost estimates are preliminary, intended to inform next steps in moving the project forward to fruition.

Prepared By: Alan Lindsay Berry, AIA of Stevens & Associates, P.C., Brattleboro, Vermont



SECTION 2

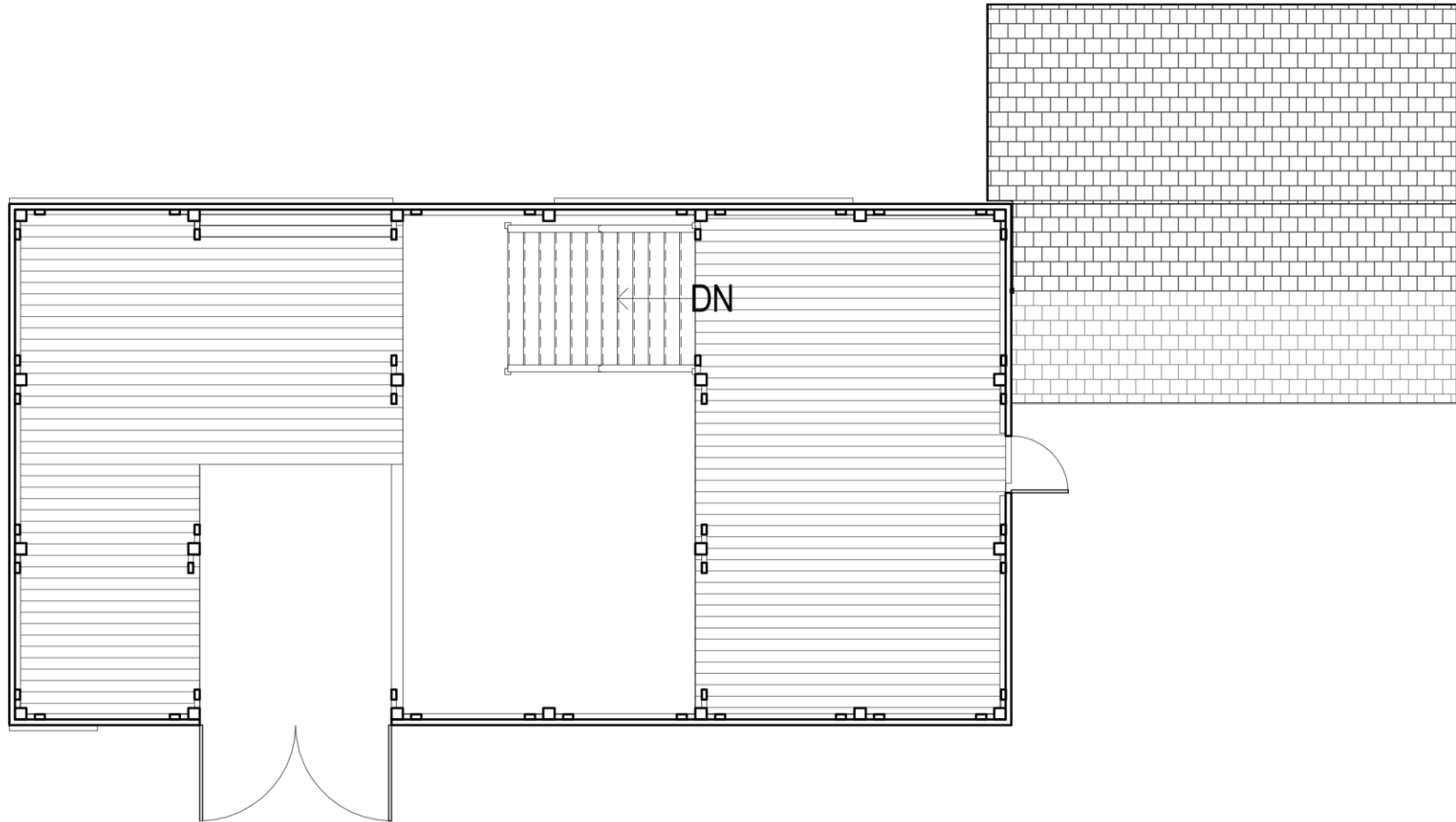
Existing Conditions



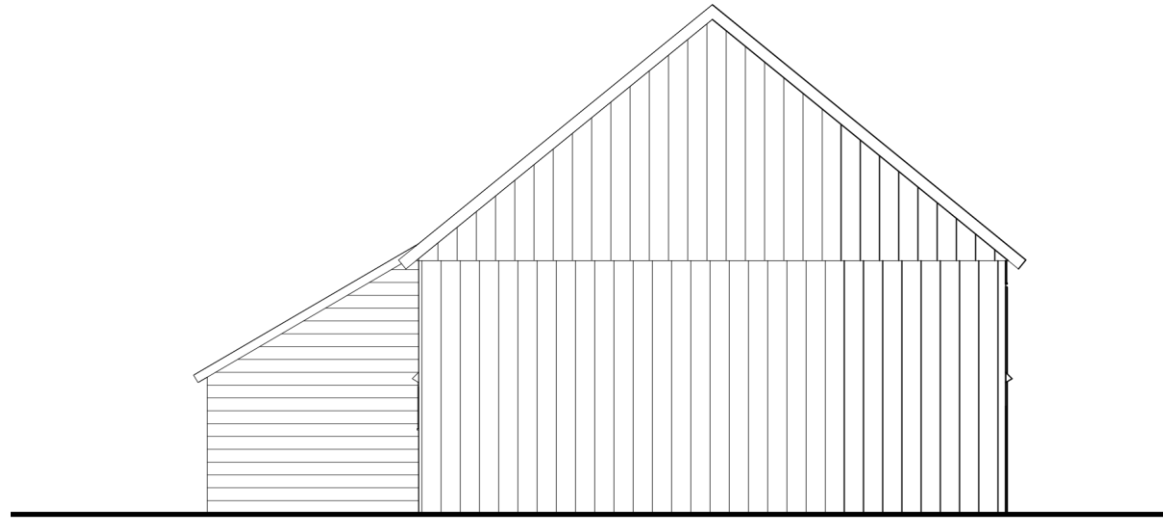
1

EXISTING FIRST FLOOR PLAN

Scale: 1" = 10'-0"



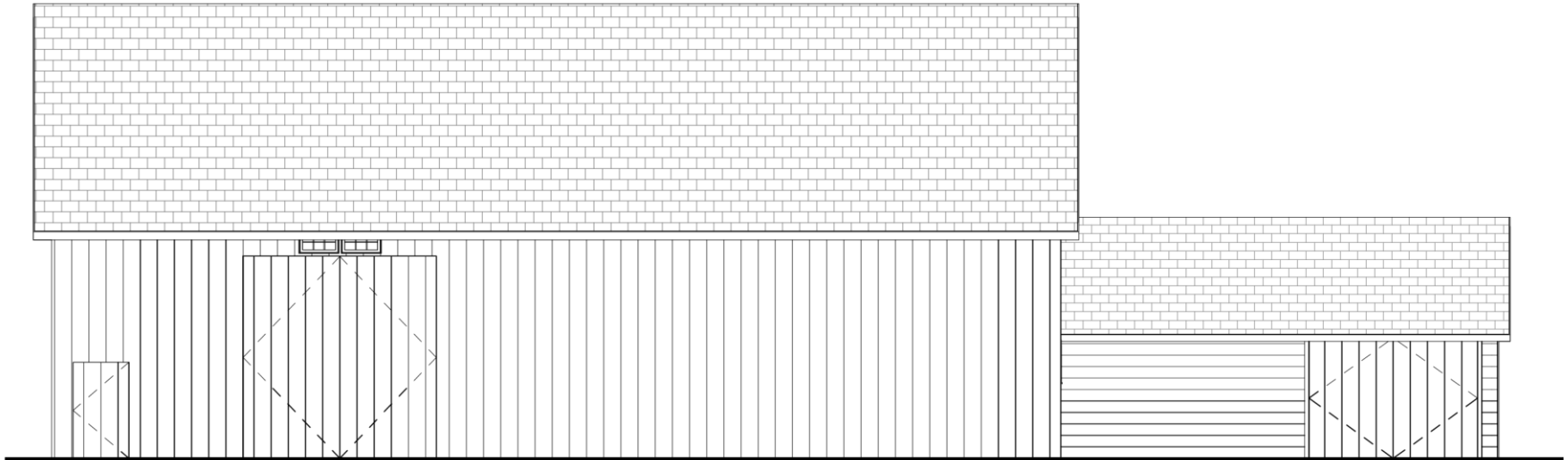
1 EXISTING SECOND FLOOR PLAN
Scale: 1" = 10'-0"



1

EXISTING EAST ELEVATION

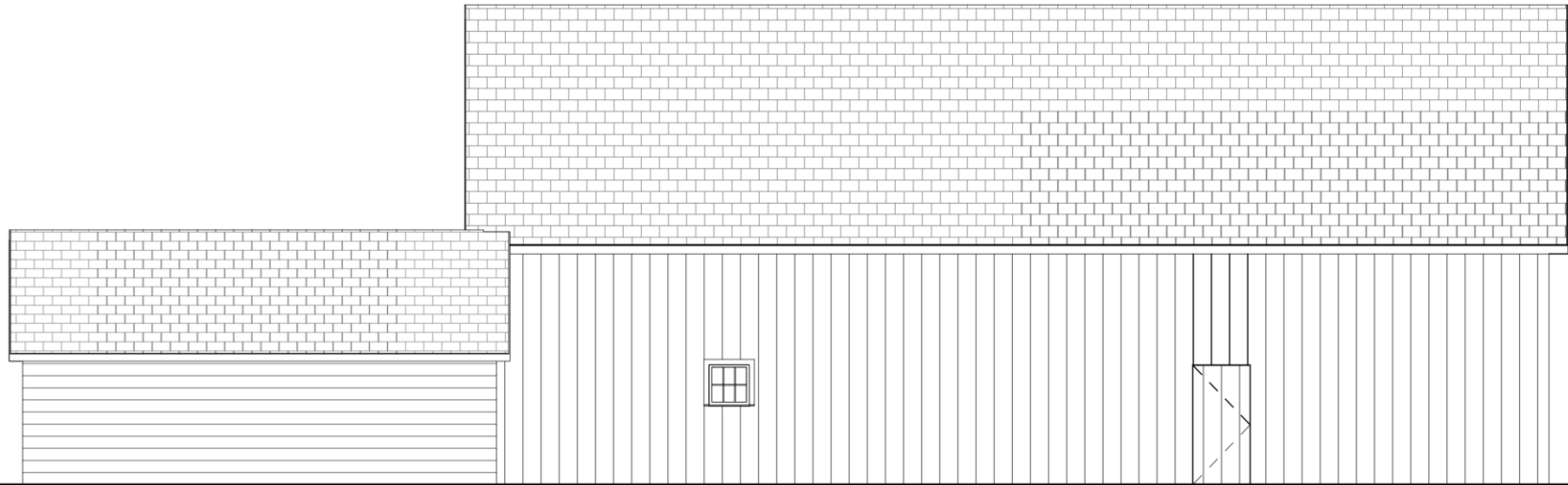
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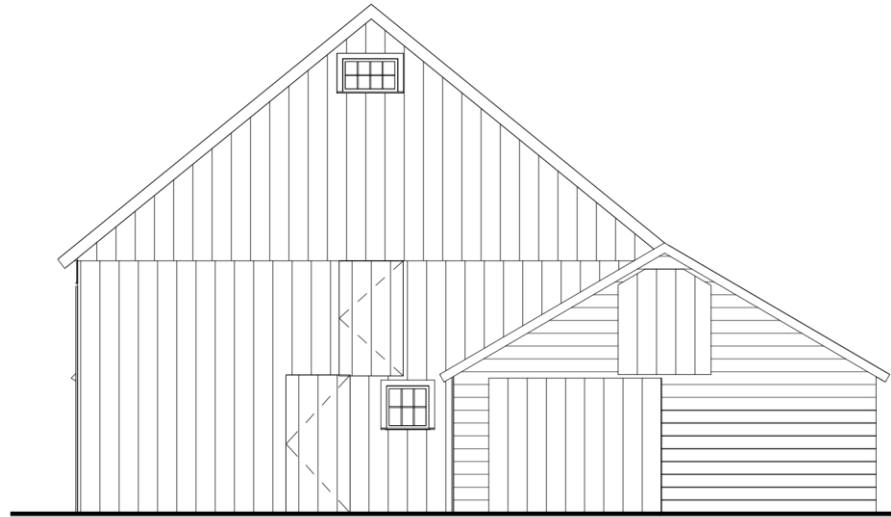
2

EXISTING NORTH ELEVATION

Scale: 1" = 10'-0"

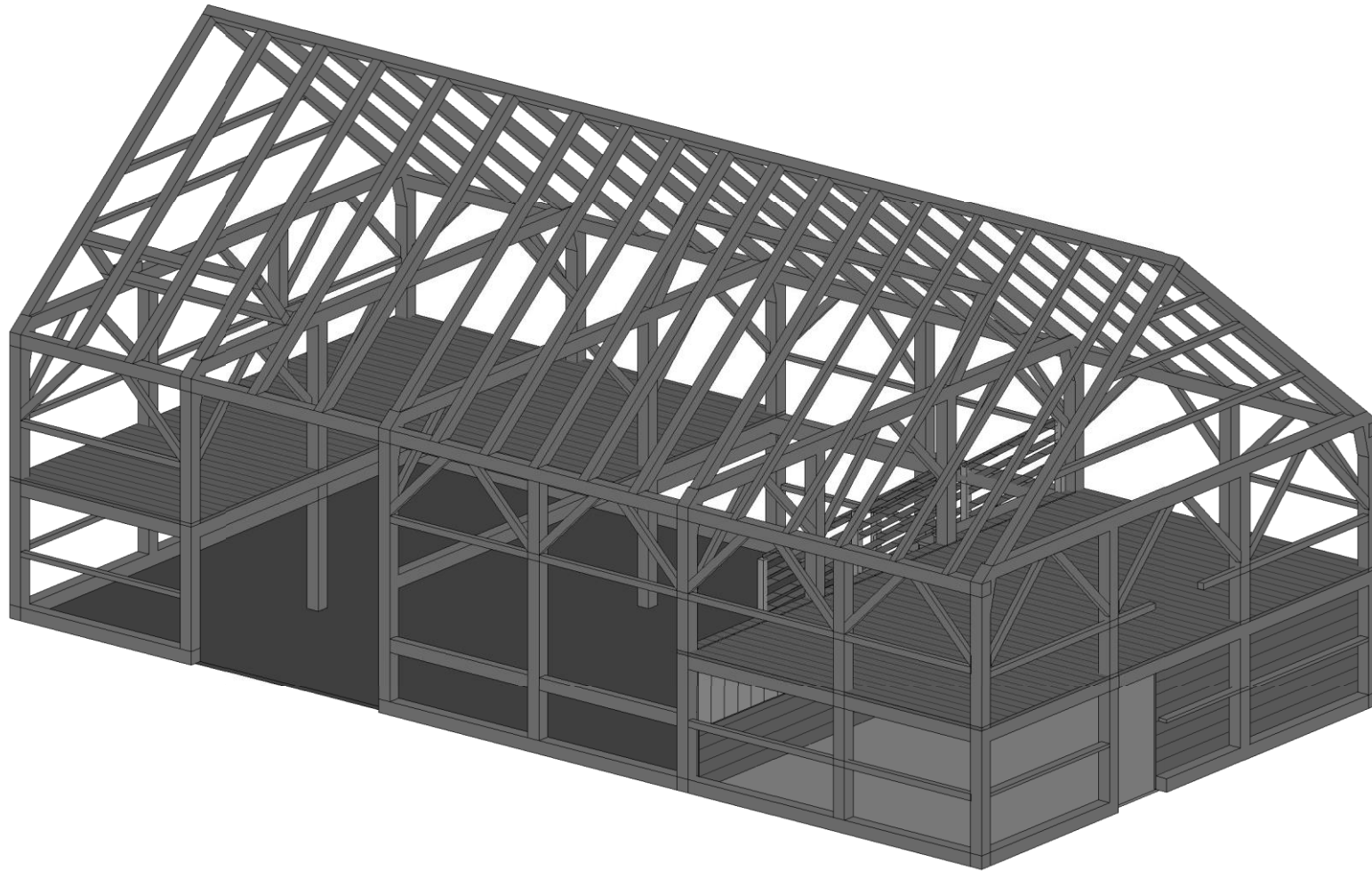


1 EXISTING SOUTH ELEVATION
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2 EXISTING WEST ELEVATION

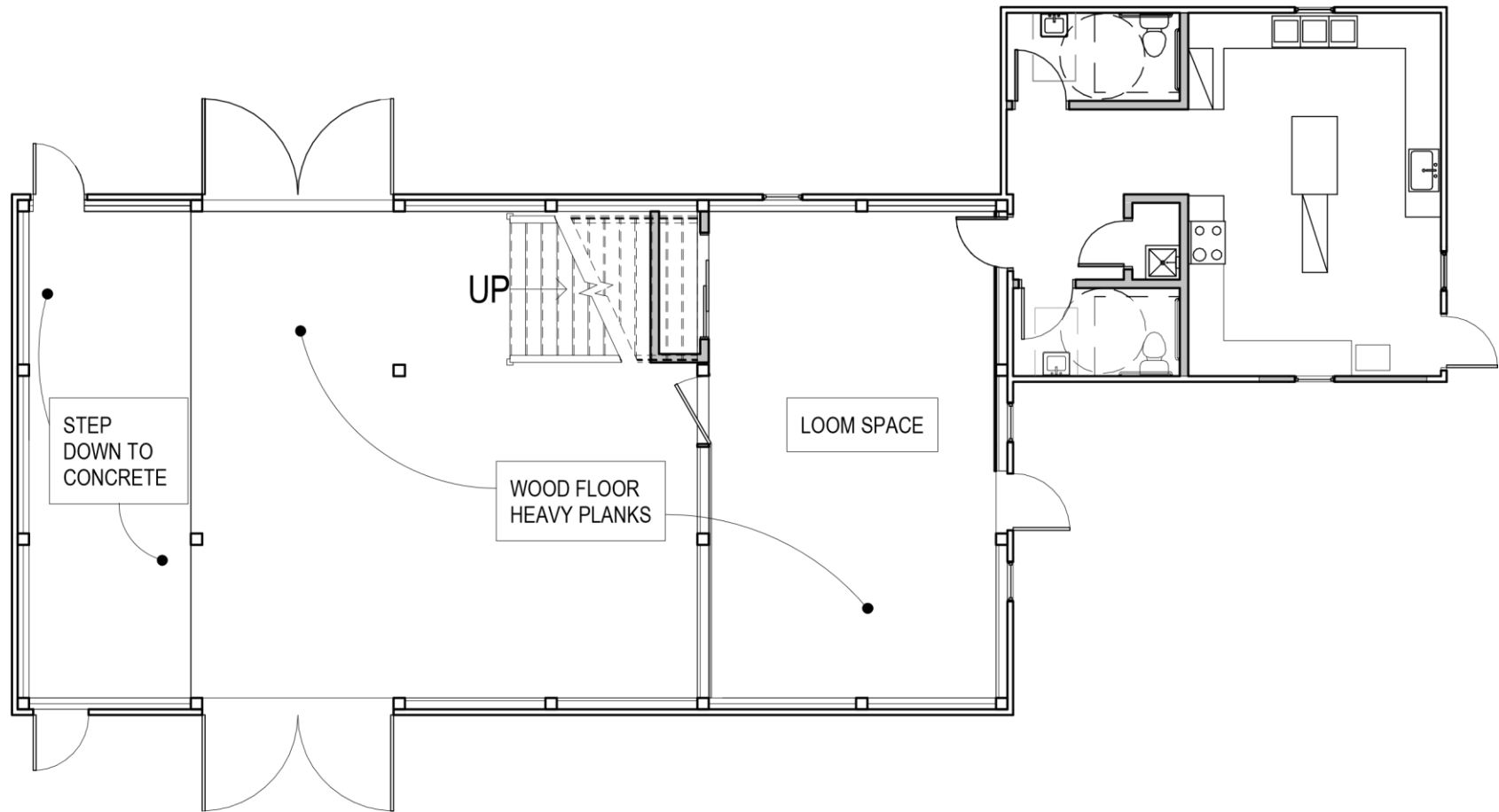
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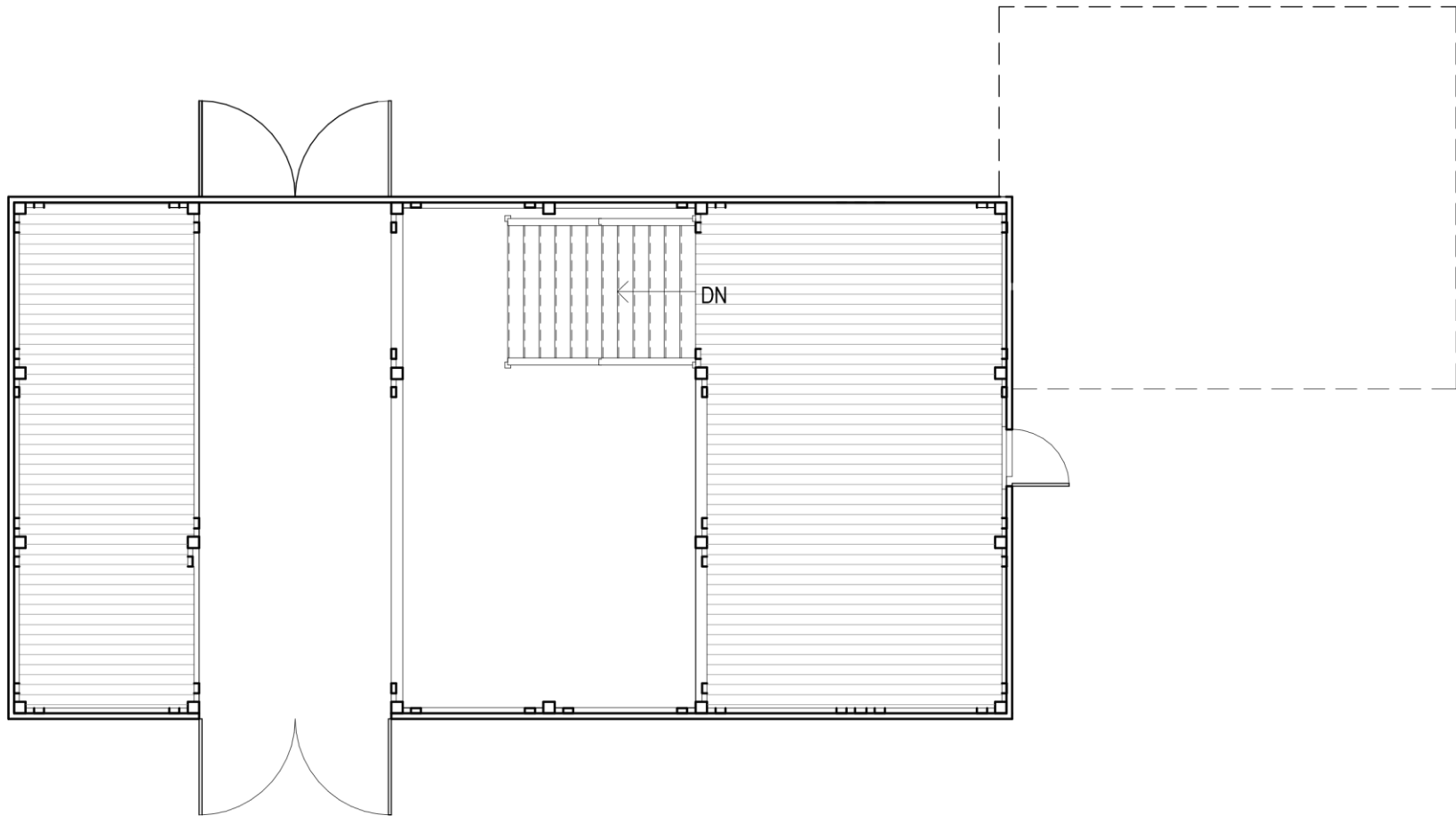
① EXISTING TIMBERFRAME
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SECTION 3

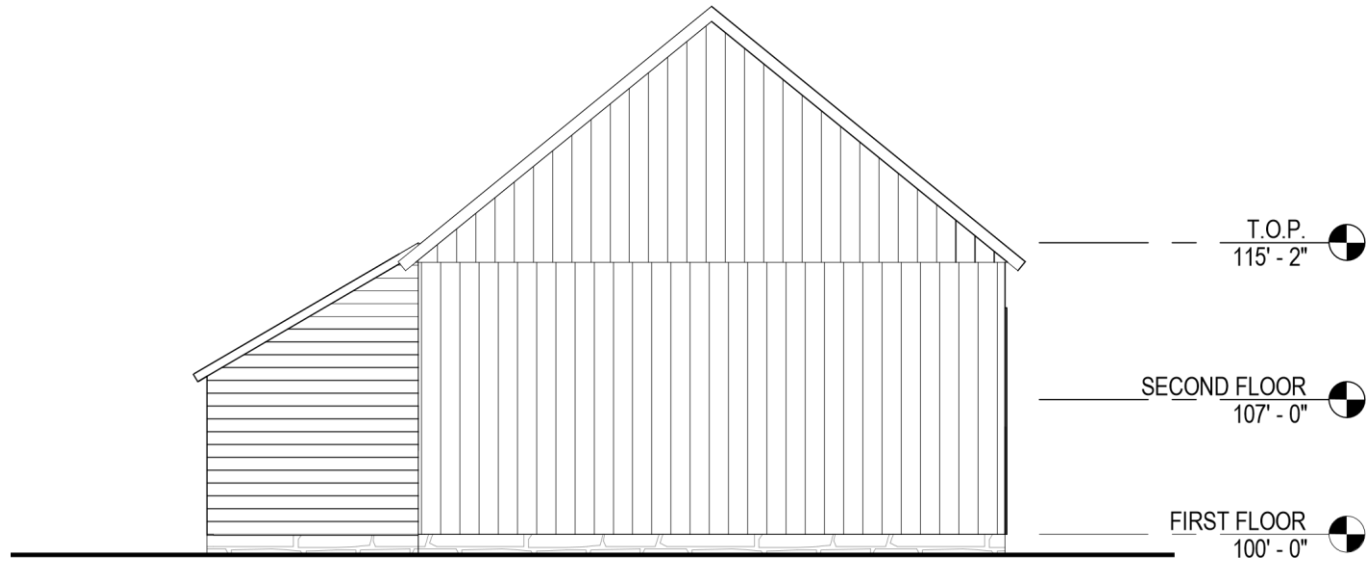
Proposed Concept Design



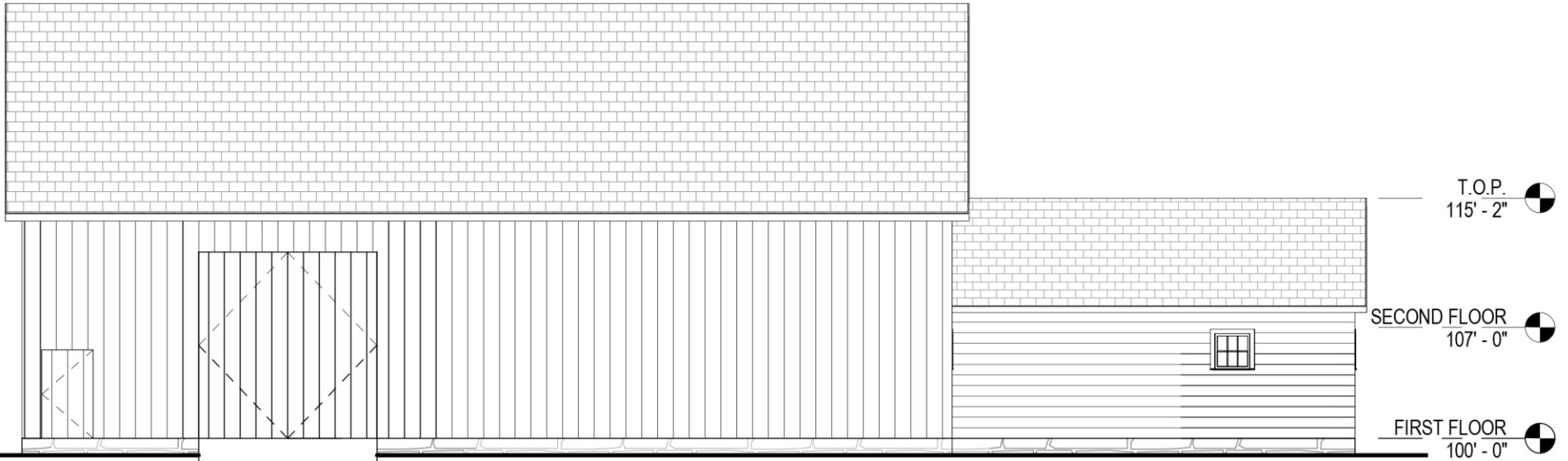
1 FIRST FLOOR PLAN
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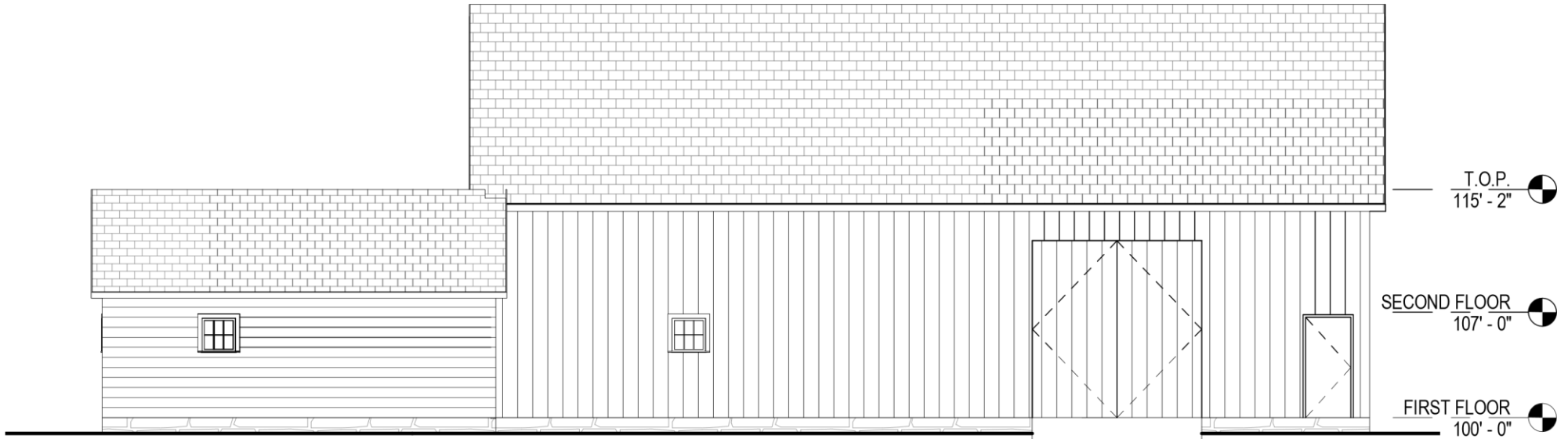
1 SECOND FLOOR PLAN
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1 EAST ELEVATION
Scale: 1" = 10'-0"



2 NORTH ELEVATION
Scale: 1" = 10'-0"



1 SOUTH ELEVATION
Scale: 1" = 10'-0"



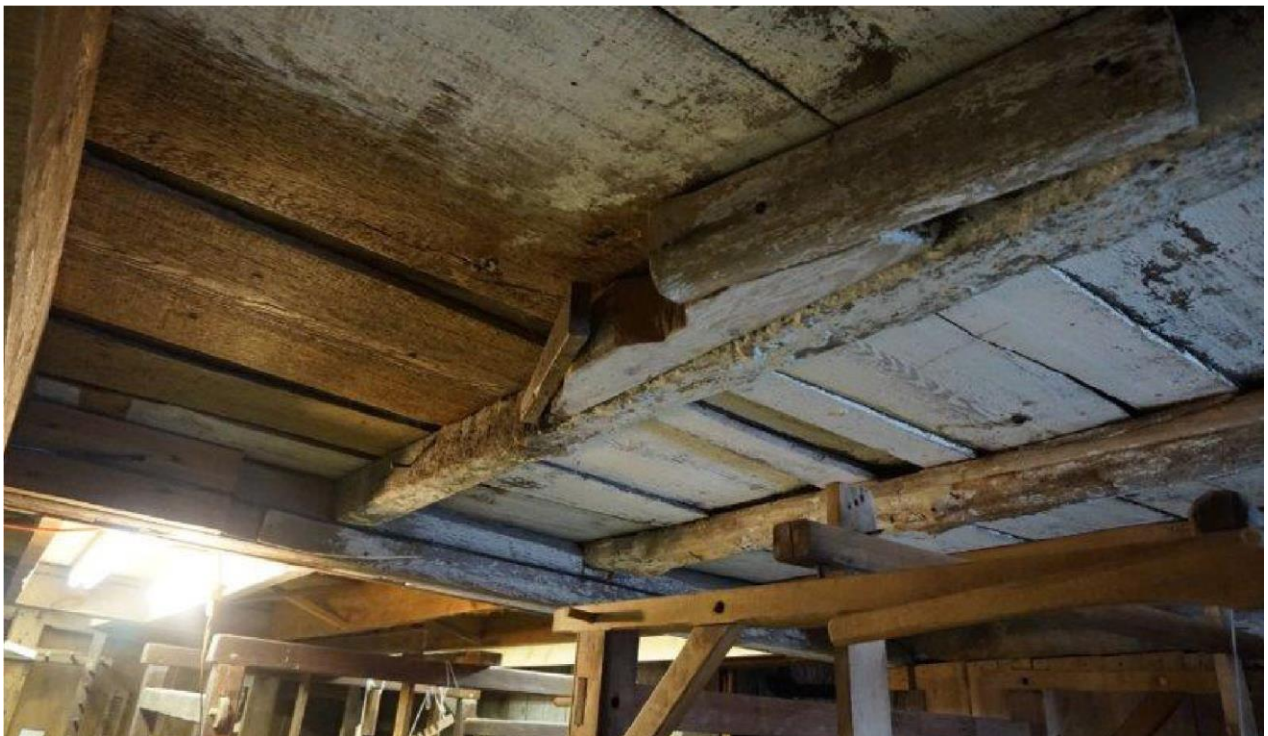
2 WEST ELEVATION
Scale: 1" = 10'-0"

SECTION 4

Photographic Survey



THE LOOMS: Antique barn looms, similar to the ones used by Eleanor Wilder Clark and “The Buckland Weavers” will remain on display in the weaving room. The blue stone pavers will be replaced with a wide plank pine floor, with heating ductwork concealed beneath the floor, extending the season for weaving.



WEAVING ROOM INSULATION: The loft floor framing serves as a ceiling to the weaving room. The framing will be strengthened to support loads at the loft above. The loft framing, along with the walls of the weaving room, will be insulated and finished with barnboard.



ROOF BRACING: Antique barn looms, temporary bracing supports one bay of the barn roof, where a structural failure occurred. The post and beam framing will be reconstructed at this area, to eliminate the need for bracing, and return to the original farming appearance.



RAFTER BEARING: The rafters below the temporary bracing have lifted up off of the top girt, where they were originally bearing.



TIMBER FRAMING FAILURE: The post and two braces at the hayloft, beyond the threshing floor, have dropped and their connection to the girt above has completely failed, due to a post removed from the girt below, resulting in substantial sag over a long span.



POST TO GIRT CONNECTION FAILURE: The post to girt connection has failed, with a second timber added below the original girt, a blocking added where the timber meets the post, and a spline

nailed alongside the connection. A proper connection needs to be restored, with timber replacement as necessary.



THRESHING FLOOR: The hay wagon is located where the threshing floor will be restored, with a second set of barn doors installed where they were previously removed. The current asphalt floor will be replaced with wide pine planks, cut from trees on the Wilder homestead land.



EXPANDED HAY LOFT: The expanded hayloft will be removed, where it was extended out over the threshing floor, thereby blocking the location for the second set of barn doors. The Buckland Historical

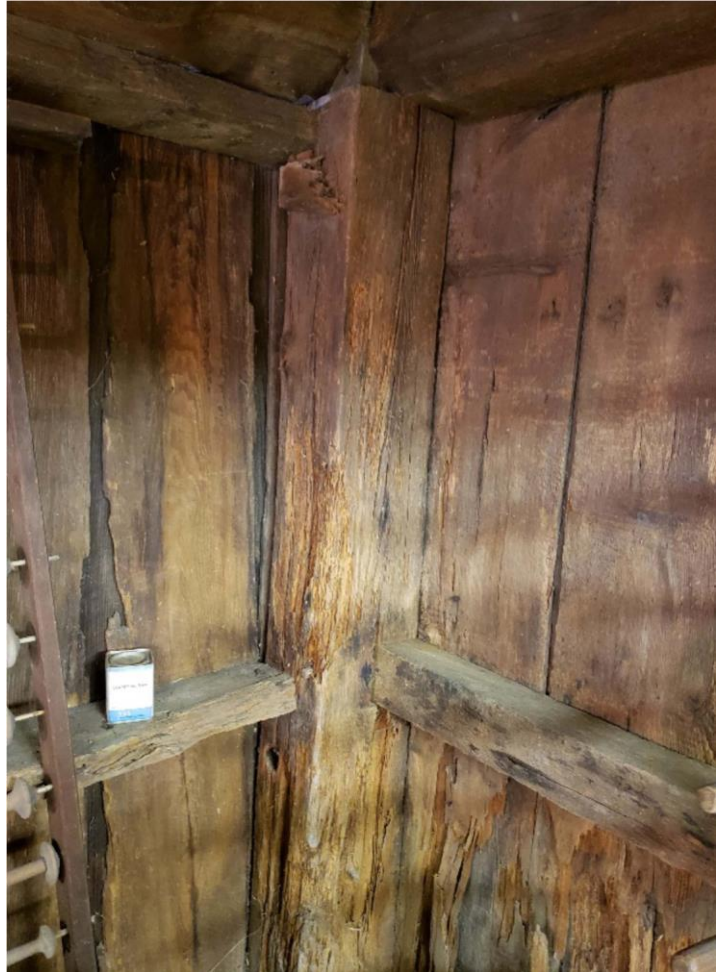
Society will inventory their farm implements, with display areas at the animal stalls, and at the hayloft above.

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TIMBER AND BARNBOARD DETERIORATION:

A resistance drill was used to determine the integrity of timbers, such as this one at the corner of the weaving room. This timber was sound, although others were not. There are two layers of barnboard for weather tightness. The lower

18 inches +/- are deteriorated, where the lack of foundation leaves the boards touching the ground.



PEOPLE DOORS:

The two corner people doors will be restored at the animal stall area. Period style thumb latches and strap hinges will be used, likely fabricated at a local blacksmith's shop.

Exterior Photos



WEAVING ROOM ENTRY & ADDITION: The door to the left of the window is the entrance to the weaving room. This door, along with other public entries will be made accessible with a removeable wooded ramp. A wood grab bar will be placed beside each entry door. This was an effective solution used at our previous colonial period barn restoration in Little Compton, RI. Accessibility was provided, while maintaining the historic character of the barn.



CATERING KITCHEN & RESTROOMS: The garage addition to the barn is beyond repair and will be demolished with a new addition constructed in its place. The addition will approximately fit the footprint of the existing garage, with the same exterior barnboard siding, door with strap hinges, and slate roof. The intent will be to maintain the character of the barn.



NORTH FAÇADE: With a new concrete foundation, concealed by a fieldstone veneer, the sill plates will be out of the dirt and protected from rot. An earthen ramp will provide at grade access to the barn doors, and the threshing floor inside. The slate roofing shingles will be removed and reinstalled following framing and roof deck repairs. Additional slate will be required to replace broken slates and to repair areas missing slate, such as the area above and to the left of the barn doors.

EAST FAÇADE: The barnboard on the east façade has been recently replaced, and does not have the deterioration along the lower eighteen inches as the other exterior walls have. The height of the existing minimal fieldstone foundation will be increased to keep the wood off the ground. A hayloft vent window will be added high up the gable to match the window on the west façade.



Exterior Photos



ROOF OVERHANG SUPPORT BRACKETS: This photo is too dark and needs the exposure adjusted. Replacement of any deteriorated or missing roof eave support brackets will be included with the roof restoration. These brackets are similar to the ones on the Little Compton Historical Society's barn, with those supporting wood "V" shaped gutters.

HAY LOFT DOOR & GABLE VENT WINDOW:

The window high up on the gable would have served the important purpose of ventilating the barn, in order to keep the hay from overheating, with resultant spontaneous combustion. The historical society will need to decide whether or not to retain the angled top expansion to the hay loft door, depending on the size of farm implements to be stored in the loft.

WEAVING ROOM ENTRY & HOPPER WINDOW:

The window to



the right of the entry door to the weaving room, like the other first floor windows of the barn, is a hopper style window that opens in, without letting rain inside, except during more severe storms. A matching window will be added at the opposite side of the door, in order to bring more natural light into the weaving room. Similar windows will be used at the kitchen / restroom addition, which will replace the current garage.



LATER DOOR: This door is not part of the original four bay barn, and is located at the 5th bay, which houses the weaving room on the first floor.

The additional bay is not recent, although it does have a slightly better fieldstone foundation than the original barn. The door with its strap hinges may be salvageable to relocate to the location of the missing animal stall door.



SECTION 5

Structural Assessment

Buckland Historical Society Barn

Wilder Homestead Property, Ashfield Road
Buckland Historical Society Buckland, Massachusetts

Structural Assessment Prepared by:
Stevens & Associates, P.C. June 17th, 2020



Introduction

This report summarizes our assessment of the existing barn located at the Wilder Homestead on Ashfield Road (Route 112) in Buckland, Massachusetts. The observations made in this report are based upon a site visit conducted on February 5, 2020. The primary focus of this assessment is to make an effort to identify areas of the structure that may require attention in the near future and to recommend conservation-minded strategies for the repair, replacement, or supplementation of the existing structural components. Furthermore, we understand that proposed modifications to the barn ideally include creating a conditioned space in the current weaving room area as well as installing new concrete foundations and a slab on grade floor beneath the Main barn. The design of these alterations is beyond the scope of this assessment; however, an effort has been made to understand possible

structural implications of this modification and provide general guidelines to consider for this future scope of work.

The complete barn structure is comprised of two distinct structures; a large two-story Main barn, and a smaller single story Shed projecting from the side of the Main barn. Both portions are simple gable roofed structures with the roof ridge running approximately east-to-west; the west end faces the road. The oldest portion of the Main barn consists of hewn timbers and was reportedly built around 1798. The original structure was a very traditional English Barn style consisting of three-bays (four timber frames), with a large door under the eaves and a central aisle, which would often serve as a threshing floor. A fourth bay was added to the west end of the original structure around 1840 and includes the space that now houses the weaving looms. The 1840's addition is the same width and height, matching the original barn, however the timbers are sawn rather than hewn. The single story Shed at the front of the Main barn is believed to be of early 1900's construction and used sawn lumber rather than traditional timber framing. At this time, we will address the condition of the Shed in limited detail, as we understand future plans likely involve replacing this structure.

Existing Conditions & Recommendations

This assessment includes visual observations of the existing conditions, review for distress or deterioration, and limited measurements to document the existing structure. Overall, much of the original structural appears to be intact or to have been replaced with similar framing. Additionally, a considerable amount of sill work has been done, as well as post repair efforts. In general, the shoring and repair work on the structure appears to be a result of moisture and decay rather than structural failures or alterations.

In existing structures, the standard of review is to base the adequacy of the framing on observable distress and deterioration unless we are changing the historic loading patterns. This is based upon the assumption that the structure has experienced design loads through the life of the building and that the actual strength of materials may exceed current assumptions. Based upon this initial review and our initial discussions regarding the proposed future use of the building, it is our opinion that turning the weaving room into a conditioned space will have little to no effect on the historic loading pattern for the majority of the structure. As such, the adequacy of the framing for proposed future use has been based upon observations of distress or deterioration. Stress calculations for the existing loft framing were performed.

Main Barn – Roof

It is our opinion that the historic loading on the roof will not be increased by more than the permitted 5% by creating a conditioned space in the current weaving room. The building is not heated and not insulated, as such, space in the Main barn stays the same temperatures as the outside, and any heat source that may be in the conditioned space still will not cause any accumulated snow to melt off of the roof. Therefore, we have based the adequacy of the existing structure for the proposed future use primarily from observations relating to how the current structure is performing and its condition.

The roof structure consists of common rafters and a ridge pole. The rafters are sawn timbers ranging from about 7" x 6" to about 5" x 4" at the gable ends. They appear to be uniform along their length (not tapered) although the ends at the ridge and the ridge pole were not measured.

Line and Grade -

There is an observable sag along the ridge line and a more subtle but similar sag along the eave lines. Sighting down alongside the structure the eaves appeared particularly straight, as far as any outward bowing along the length of the barn, for a building of this age and roof construction. The rafters did appear to have slight bellying along their length.

The minimal outward movement suggests that much of the sag may be a result of the supports settling or in some cases deteriorating, as well as a cumulative effect of the rafters developing some sag. This condition does not necessarily need to be corrected and would be difficult to correct as wood tends to develop a "memory" of its deformed shape, however, steps should be followed to help prevent

this condition from worsening. The proposed foundation and the following recommendations regarding the roof framing should limit additional sagging.

Condition of Rafters -

This style of roof framing has little redundancy built into its design. Each rafter is supported by an opposing rafter on the opposite side of the roof; effectively leaning on one another. As a result, each rafter acts like a beam as well as post (experiences bending and compression forces). The large timber wall plates at the bases of rafters must support both the vertical



weight of the roof and an outward push from the sloping rafters. These large timber wall plates are able to resist the outward push because they are connected to large continuous beams that span the entire width of the barn and keep the walls from spreading outwards.

Overall, many of the rafters appear to be in fair condition. There are two areas, however, where past roof repair efforts appear to have left the rafters compromised. These are the same areas that are also missing slates. Referring to the attached plan sketch, along the south eave (grid A) in the third bay of the Main barn (between grids 3 and 4), the bottom end of the one rafter has been sawn off and new end pieces have been spliced on. In this same location permanent shoring has been installed in the form of a newer purlin beam that spans from Bent 3 to Bent 4 and directly supports the rafters (pictured below, left). This shoring seems to have caused a loss of bearing at the bottoms of the rafters as well (below, right).

The recommendation at this location is to shorten the posts that support the permanent shoring beam, allowing a small gap between the rafters and beam, while also allowing the ends of the rafters to be supported by the wall plate timber. The small gap should be shimmed and fasteners should be installed attaching the rafters to the purlins. Similarly, fasteners should be installed at the base of rafters, securing the members to the wall plate timber. Additionally, because these rafters act as both beams and posts, the rafter that has been cut should be sistered with new framing that spans from the ridge pole to the eave. The new framing should be fastened to the existing rafter as well as at the ridge and eaves.



A second location where the roof framing has been compromised is along the south eave (grid D) in the first bay of framing (between grids 1 and 2). This area is also missing slates. A rafter end has been sawn off and permanent shoring has been installed (pictured left).

The recommendation at this location is to sister the existing rafter with new full length framing that spans from the ridge pole to the eave and is anchored at each end as well as along its length.

Condition of Timber Wall Plates and Tie Beams –

The timber wall plates play an important role of restraining the outward push from the rafters as well as carrying the weight of the roof. The wall plate along the north wall was mostly observable, however the south wall plate will need to be accessed with a ladder to fully assess the condition.

Two locations along the south wall plate showed signs of distress. The first location was at the connection between the wall plate and the gunstock post at the tie beam along grid 2. At this location the wood in the wall plate appears to have deteriorated, likely due to repeated exposure to moisture at some, possibly prior to the more recent roof repair efforts (pictured left, shining



flashlight at underside of wall plate into connection with gunstock post). At the time of the visit, the area was observed to be dry and it is not clear how long this condition has existed. The connection of the tie beam to the gunstock post actually seemed in fair condition but should be more closely investigated. This connection is a critical connection as the tie beam functions to keep the walls from spreading outward and this restraint requires both the tie beam and wall plate to be adequately secured to the post.

The recommendation at this location is to reduce the loads on this connection and prevent moisture from causing further decay. The existing timber is deteriorated but appears to still be whole or intact. Methods to reduce the stress on this connection include installing metal tie rods on either side of the connection that span the width of the barn and are anchored into sound wood. This will provide an alternative path for the lateral loads on the wall plate that does not utilize the post connection. The gravity loads on the beam can be reduced by adding support posts along the wall near this connection. As an alternative, the timber, or a portion of the timber could be replaced in-kind. Special care should be exercised by a Timber framer with experience in historic preservation to match existing joinery work and provide adequate splices if only a segment of the timber is replaced.



It is also recommended to inspect all of the other connection locations where the tie beams are joined to the exterior columns.

A second location that may have showed signs of distress is at the intersection of grids 4 and A. Prior to the 1840s addition of the 4th bay of the Main barn, this column would have been the south-east corner of the structure. When the addition was constructed, a new section of wall plate was spliced into the joint at the corner. This appears to be a somewhat improvised joint, making it difficult to assess if it has moved or been modified from its original as-built condition. The joint doesn't seem to have failed, but it is recommended to engage an experienced timber framer to evaluate this condition and possibly recommend strengthening approaches.



Main Barn - Frame

Much of the interior of the Main barn is a tall single-story space with lofts at either end of the barn. The ground floor bears directly on the earth as there is no crawlspace or cellar. The primary loads on the frames are from the roof structure. The proposed alterations mostly relate to the ground floor, with the potential exception of the loft above the weaving room, and therefore will not increase the loading on much of the building frame.



Condition of the Beams –

There are very few interior beams in the Main barn. Aside from the tie beams already discussed, there are three beam lines along grids 2, 3, and 4 that are approximately 6-ft above ground level. The only beams that show clear signs of distress or deterioration are the two beams along grid 2. These beams support the interior edge of the loft at the west gable end of the structure. The beams have deflected significantly and show signs of crushing failure at their bearing locations (pictured left). Past repairs are also evident such as adding beams below and alongside the framing.

The recommendation at this location is to clear off the loft space and no longer use it for storage, or very light storage at the most. The distress seen in the beams is likely a result of this loft being overloaded. If the loft remains vacant, then the existing beams can remain, and the recommendation is to strengthen the damaged connections at the ends of the beam and restore bearing.

Condition of the Lofts –

There are two lofts in the Main barn, one over the weaving room in the fourth bay of framing, and another along the rear gable end wall over the first bay of framing. This second loft also partially extends over a portion of the second bay of framing along the north wall.

A considerable amount of newer framing is evident at the loft over the weaving room. As you enter the room through the exterior door in the west gable end, two large 8" x 8" timbers span across the weaving room in the east west direction and divide the framing above into three distinct sections. The south and middle sections of framing (between grids D and C, and C and B) appear to be newer, while the northern bay (between grids A and B) is a mix of old and newer members. The condition of the framing in the first two bays is good. The first bay consists of rough sawn 4" x 6" joists spaced at 30" on center. The second bay of framing consists of rough sawn 2" x 8" joists spaced at 24" on center. The third bay is irregularly framed; there are 4" x 4" joists, one of which is in poor condition, there are round timbers, new 4" x 6" and new 2" x 8" joists in this section.

A limited analysis determined the following approximate load capacities for the loft framing. The species of the lumber used in framing the original barn structure and the addition is not certain, but it is likely one or more of the softwood species often used for framing in the region such as pine, hemlock, spruce, or fir families of softwood. Most of the framing lumber

appears to be decent quality, by today’s grading likely No. 1 and No. 2 grades. There are no established engineering design values for older growth or ungraded timber. Based on experience and engineering judgment, a range of allowable bending stresses from 875 psi. to 1200 psi. for lumber 2”– 4” thick, and 850 psi. to 1100 psi. for timbers 5”x 5” and larger were used as a frame of reference in this analysis to determine the approximate load capacity of the loft framing. Sampling and testing the wood framing is the only way to accurately determine the appropriate allowable design stresses for analysis.

MEMBER	LOAD CAPACITY (AFTER 15 PSF. ASSUMED PERMANENT LOADS)	ALLOWABLE OCCUPANCY (BY ASCE 7-10 STANDARDS)
4”x 6” Joists @ 30” on-center Span ~9’-0”	51 psf. – 76 psf.	Classroom, Offices
2”x 8” Joists @ 24” on-center Span ~9’-3”	55 psf. – 82 psf.	55 psf. – 82 psf. Classroom, Offices
8”x 8” Timber Beam Span ~17’-0”	2 psf. – 9 psf.	Uninhabitable attic w/o storage, Awning

The limiting framing is the large timber beam, by far. This is primarily a consequence of the long span; the capacity of the beam decreases exponentially as the span increases. Empty mortise joints suggest braces and posts, or a stud wall, used to provide additional support and decrease the span length. These features have since been removed. If the proposed future use requires occupying the loft space, then these beams should be strengthened. The beams can be strengthened by reducing the clear span by installing braces or posts. This may hinder the usefulness of the first-floor space as it would limit being able to move around the large looms. An alternative may be to construct a new floor at the loft level that is above the existing framing and supported independently from the existing framing (clear span the whole weaving room).

The rear loft simply consists of 2” planks oriented flatwise spanning across the first bay of the barn. There are no joists. The limiting criteria for this loft is that planks will deflect under very light loading, creating a “bouncy” feel to the floor even before they reach their strength limit. Because of this, the recommendation is to not use this loft, especially for any sort of occupant loading. The loft can still serve as a ceiling to the space below it, and it okay for using it to access other areas of the barn, but otherwise the loading on it should be restricted.



Condition of the Posts and Post Bases –

Many of the posts were in fair condition and a considerable amount of effort has gone into repairs of posts bases. The key condition related concerns are as follows:



Post A/3.5: Significant deterioration was observed at two locations on this post; first at the first wall girt framing connection, and second near the eave line, which appears to have started as a natural defect in this timber.

The recommendation is to replace this post. The attached resistance drill readings confirm that very little sound wood remains.



Post C/2: This post appears to have settled and the top is no longer engaged in the tie beam at the eave level. The possible causes of this include an inadequate foundation, overloading from the loft, and/or deterioration of the post base.

The recommendation is to re-use this post. Much of the post appears to be in fair condition. The new design work should include a properly sized foundation, and potential repair work to the base of the post. The post should be re-set into its original configuration.

Post D/4: *Deterioration was observed at the location where three wall girts frame into this post. Because of this connection, the section of this post was already reduced, and now the remaining wood appears to be compromised. Resistance drilling confirms that there is deterioration at this joint.*

Much of the post is still in fair condition and could be reused. The recommendation is to strengthen this section of post with timbers that bridge over the damaged area. This will require re-working the connections of the wall girts to the new framing around the post. Alternatively, this lower section of post could be replaced.



Other general observations and recommendations are as follows:

- The corner columns were not observable on two sides and in some cases difficult to access. The condition of these columns should be assessed during the repairs or at a time when some selective demolition is acceptable.
- The connection between the large beam along Grid 2 and the post at D/2 is obscured. There does appear to be deterioration in this area, however it was not clear if it was from the beam or post, or both. Resistance drilling suggests some decay in the post above and below the joint, but also a fair amount of sound wood. More of this post needs to be exposed and inspected, the lower portion of the post may need to be replaced. This post is a gunstock post (flared top) and has significance that should be preserved. This is likely achievable as the upper portion of the post appeared to be in fair condition.
- Many post bases have been repaired using blocks of wood placed horizontally on the sill beams. This appears to be performing acceptably. The recommendation is to supplement these locations with structural wood screws to provide a more complete connection from the column to the foundations.
- A general recommendation regarding the post bases after the new concrete slab has been placed is that the wood should not bear directly on the concrete as this tends to create a wicking effect in the end grain of the timber, causing rot. Post bases that provide a standoff from the floor should be used and the end grain of the post should be treated with preservative treatment.

Condition of the Sills and Foundations–

As is common with this era of barn, the sill beams at the base of the walls are very close to finished grade, essentially right at grade level. The foundations were not observable along most of the barn. At one location it was determined that the foundation looks to consist of dry-laid field stone which would typically extend a few feet below ground.

It is evident that many of the sills, likely all of them, have been replaced since the 1790's and 1840's construction. The sill replacement has occurred in sections and the result is that there are now many separate segments of different age and condition. Only the tops and inside face of the sills were visible in some locations. In some locations the sills appeared to be partly below grade. Not enough of the timbers were observable (could not observe bottom or exterior), to definitively determine which sections need to be replaced. Much of what was observable appeared to be in fair condition, however rot and deterioration are most likely to start at the underside and exterior face of the sills, which were not observable. The recommendation is to assess the sills more closely during the work related to installing new foundations.

Additionally, after the new foundations and slab has been installed, it is recommended that preservative treated (PT) lumber be installed directly on the new concrete and properly anchored with conventional anchor bolts, and then the historic sills can bear on top of the PT plates and be anchored with fasteners.

Lastly, since many of the sills have been replaced, it is likely that the original post-to-sill timber joints were altered, or sawn off entirely as many of the post bases have been replaced. The recommendation is to supplement the post-to-sill connections with structural screws and/or metal plates.



Shed Observations –

The Shed at the west gable end of the Main barn is framed out of sawn lumber and nailed together rather than timber joinery. The structure is under-framed for any sort of occupancy other than simple utilitarian storage. The roof framing consists of opposing rough sawn rafters spaced at approximately two-feet on-center. This is similar to the Main barn, however in the Shed there are no tie beams or ridge pole. As a result, it appears that the walls have bowed outward some, and efforts were made to restrain this movement by installing one-inch boards as collar-ties (near the peak) and as rafter ties (near the eaves). The collar-ties near the peak do little for the strength of the roof and mostly serve to help hold the framing together. The rafter ties, which consisted of a mix of live edge one-inch boards, may actually be helping restrain the eaves, but the irregularities and inconsistency of the boards make analyzing this framing very challenging.



Only a small portion of wall framing was observable; much of the interior has been sheathed with plywood which has likely contributed to the Shed's overall stability despite being so lightly framed. The portion of wall framing that was observable appears to be infill framing where a large opening once was. The beam over this opening has deflected significantly and the newer infill framing offers little additional support.

Lastly, no foundations were observed below the Shed. Based on experience, there may be a stone foundation, or individual stones used to support posts, but if so, these have sunk into the earth such that the framing appears to be in direct contact with the ground. Since the framing is smaller sawn lumber material rather than large timbers, it is likely that there is significant decay at the base of the walls.





A substantial amount of work would be recommended in order to lengthen the useful service life of this structure for continued use as a Shed. The work would have to include installing ceiling framing (rafter ties) and strengthening the rafters, sill repair, stud repairs and strengthening, as well as installing some sort of foundation walls or concrete piers.

Our understanding is that the Historical Society would ideally like to use this space as a commercial kitchen. This will likely require additional efforts as far as creating serviceable and sanitary floors, walls, ceilings, drains, supporting HVAC equipment, as well as any life safety and fire code requirements. The finished structure will likely have very few original features or framing.

The recommendation regarding the Shed includes either continuing to use the space as just a shed for equipment storage and make the repairs outlined above, or if the space is going to be turned into a more commercial, finished, accessible space, then much of the framing will require restructuring. Some of the architectural features may be able to be incorporated into the final design.

We would be happy to work with you to review your plans to modify the structure and to assist in developing any needed designs or detailing to facilitate that effort.

As always, please contact us if you have questions or want to review these findings. Sincerely,

Benjamin Harwood, PE
Project Engineer
Stevens & Associates, PC

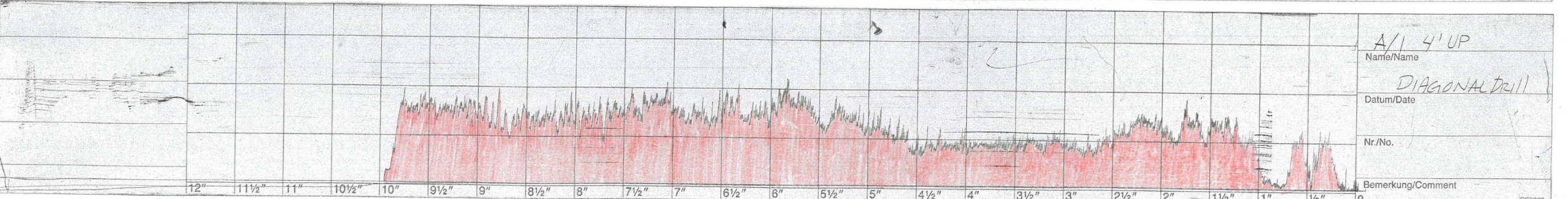
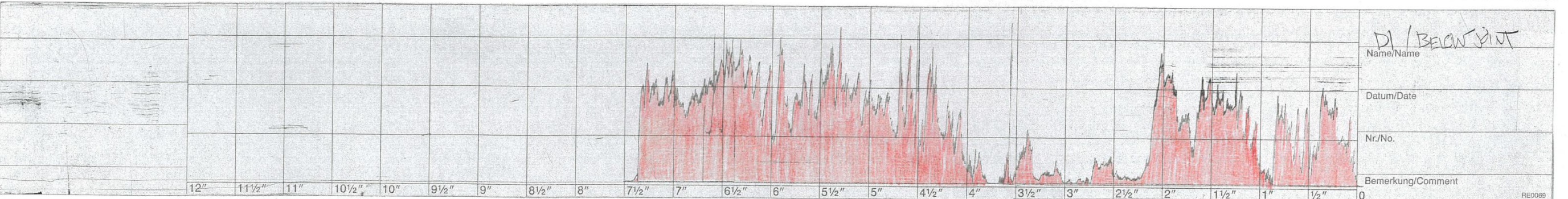
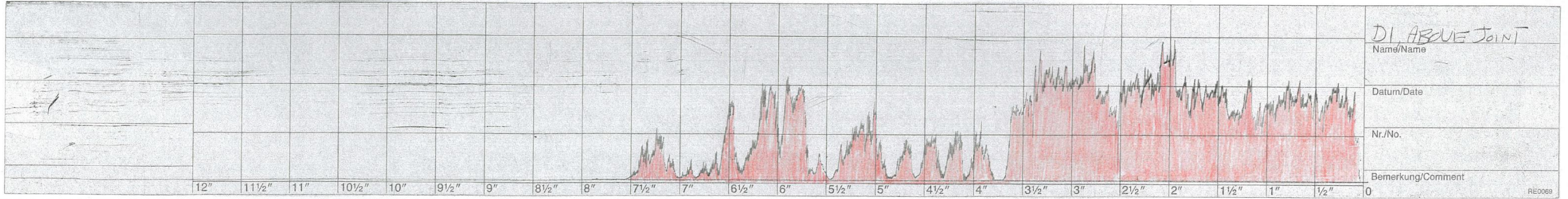
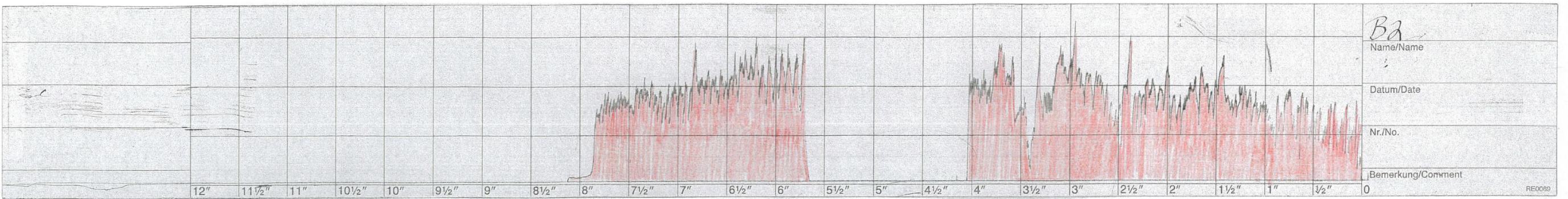
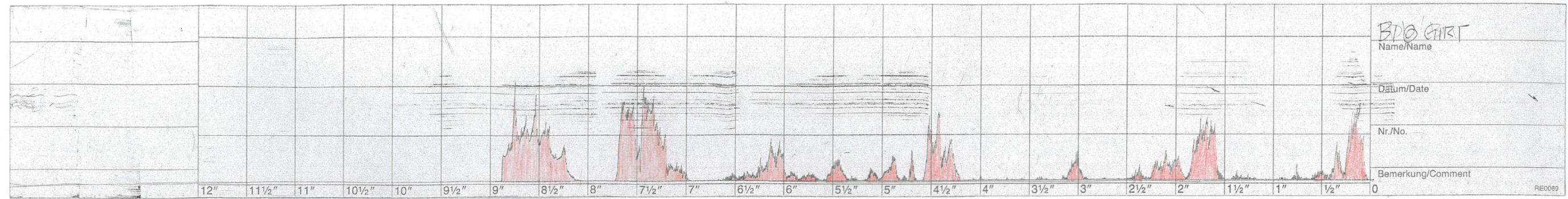
Bruce Sanderson, PE
Principal
Stevens & Associates, PC

SECTION 6

Resistance Drill Printout

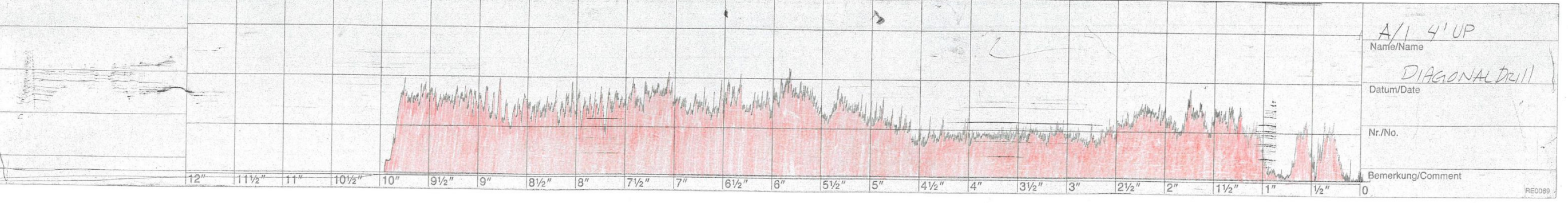
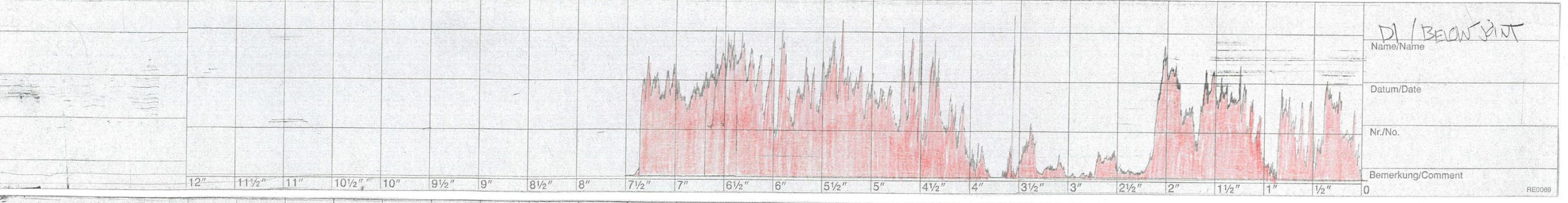
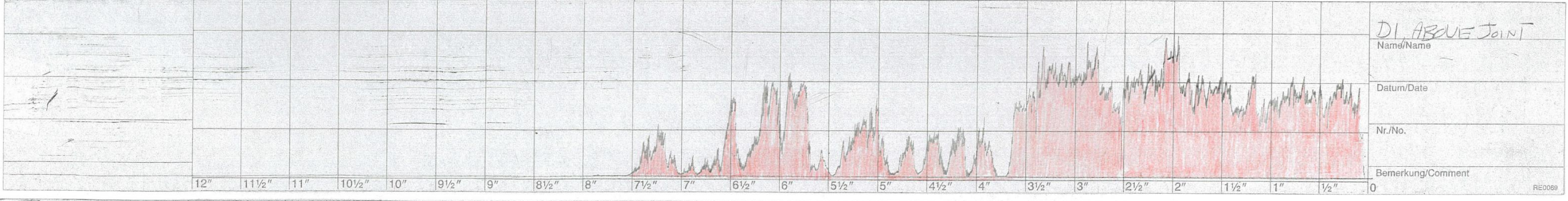
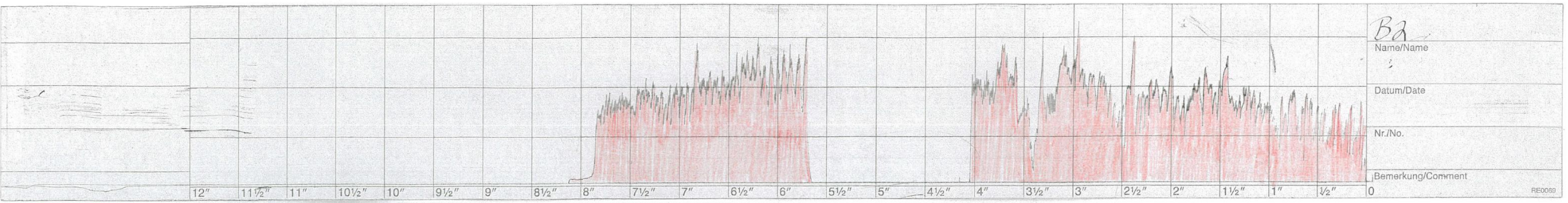
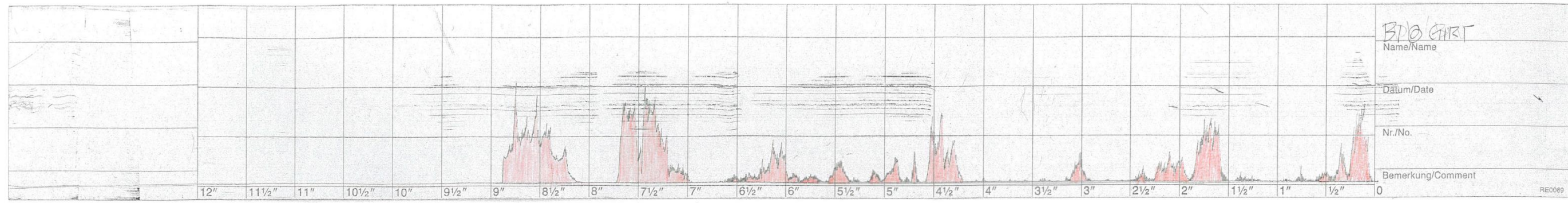


Resistance Drill





Resistance Drill



SECTION 7
Specifications



Buckland Historical Society — The Wilder Homestead Barn, circa 1798 *Outline Specification*

PROJECT DESCRIPTION SUMMARY

Description of the Building:

The Wilder Homestead Barn, circa 1798, is located on Route 112 at Buckland, MA. The barn is one of the few remaining “English” barns on a colonial era farm in New England. The barn serves as a place to collect and display agricultural artifacts owned by the Buckland Historical Society, also has a long history of hosting weaving demonstrations.

The barn will be restored to continue its present functions, and to broaden its work as a display space, weaving center, into new ventures that serve the historical society’s mission.

The barn is a post and beam heavy timber structure, with the posts and beams assumed to be hemlock, and the double layers of siding and loft plank floors believed to be pine. Repairs to the structure will utilize these wood species, with the intent of the wood to be harvested on the farms property, and cut into timbers and boards at a regional sawmill.

DIVISION 01: DEMOLITION

01 1000 Demolition and Salvage

The garage addition has no foundation, and is structurally at risk. The garage will be demolished in preparation for the barn restoration. The barnboard siding will be salvaged.

The barn has two layers of barnboard siding, installed in a overlapping method for weather tightness . Both layers are rotted at the bottom 18 inches. The wood that can be salvaged, will be used for the inner layer. New pine barnboards cut on the farm’s land, and sawn at a local sawmill, will be used for the exterior layer.

The existing asphalt paved floor of the barn, excepting the blue stone paver floor at the weaving room, will be removed. The bluestone will be saved, although not reinstalled.

The extension of the hayloft blocking the location for the second set of barn doors will be removed and salvaged. The temporary roof repair of an area of approximately 16 feet by 8 feet will be removed.

The slate roof will be removed and salvaged.

DIVISION 02: SHORING & BRACING





02 1000 Shoring and Bracking

The historic barn has a minimal field stone foundation. In order for a proper concrete foundation to be poured, the barn will need to be jacked up, and set on cribbing, for excavation and foundation work to take place.

DIVISION 03: CONCRETE

03 3000 Concrete

Provide new foundation walls to frost depth, with a 4 inch ledge to receive field stone to conceal the concrete at the 12 inches above grade exposed at the exterior.

Provide new slab on grade at first floor. There is no basement. Suitable backfill to be provided for slab.

Provide concrete footings below the slab at interior post locations.

Provide reinforcing as necessary.

DIVISION 04: MASONRY AND STONE

04 4313 Stone Masonry Veneer

Provide field stone veneer at the perimeter foundation ledge to conceal the concrete foundation at the exterior.

Provide very short dry laid field stone retaining at either side of earth berm ramps twenty feet long tapering from grade up 12 inches to the pairs of barn doors on the north and south elevations of the barn.

DIVISION 05: METALS

05 1223 Structural Steel for Buildings

Miscellaneous structural steel, and concrete foundations reinforcing.

The timber post and beam frame is connected with mortise and tenon joinery and wood pegs. This will remain the case for the restoration. The barnboard siding will be fastened with either nails or potentially screws, to prevent warping.

DIVISION 06: WOOD, PLASTICS, AND COMPOSITES

06 1000 Post & Beam Timbers

Provide a board foot count of hemlock posts and beams as described below:

Posts: 18 – 4 foot 8x8 posts (for base of posts rot repair and height increase
12 - 12 foot 8x8 posts
72 – 8x8 sill plates This will provide 24 inch on center support
for floor planks



24 – 18 foot 8x12 beams
24 - 4x4 foot purlins 12 – 4x6

foot secondary members

Provide a cost for the sawmill work.

Barnboard Siding

Provide a board foot count of pine barnboard for the entire outer layer of barnboard for the barn, with a wall height increase of 1 foot. Barnboard siding to be 1" x 10".

Provide a cost for the sawmill work.

Floor Heavy Plank Deck

Provide a board foot count of pine 5/4" x 8" floor planks.

Provide costs for the sawmill work.

06 0573 Preservative Wood Treatment

Provide pressure treated 2x8 wood base plates for sill plate timbers to rest on at all column lines, perimeter and interior. The interior girts will support a pine plank floor deck.

06 1100 Wood Framing

The only location with 2x stick framing, will be blocking between the post and beam framing at the walls of the weaving room, and new loft floor joists at the ceiling of the weaving room. These are needed to provide insulation for the only space in the barn, planned to receive heating.

DIVISION 07: THERMAL AND MOISTURE PROTECTION

07 2100 Thermal and Sound Deadening Insulation

Exterior walls to receive 8" kraft paper faced fiberglass batt insulation.

Loft joists to receive 10-1/4" kraft paper faced fiberglass batt insulation.

Interior of foundation wall and under the concrete slab at weaving room only to receive 2 inches XPS Dow Blueboard insulation

8" diameter spiral metal ductwork to be insulated. This ductwork occurs only between the foundation slab and the wood flooring planks at the weaving room. The height of the base 8"x8" base girts, sitting on PT 2x8 sill plates allow space for the ductwork. The propane fired furnace will not be installed until Phase 2, when the kitchen/toilets addition is built.

Slate to be salvaged and reused after replacement of approximately 15% of plank board roof sheathing.

DIVISION 8: OPENINGS





08 1416 Wood Doors

The two pairs of large barn doors and smaller “people doors” are to be constructed with barnboard to match the siding.

08 5213 Windows

The windows are to be single sash hopper, tilt in windows, to match existing.

08 7100 Door Hardware

The door hardware is to be forged in traditional styles, by a local blacksmith.

DIVISION 9: FINISHES

09 0000 Barnboard

The only area to have finished walls and ceiling is the weaving room, which will have salvaged barnboard as a finish. At all other areas of the barn, the timber framing will be exposed.

DIVISION 10: SPECIALITIES

10 0000 Handicap Ramp

A portable wooden handicap ramps will be constructed for the door to the weaving room. The earthen berm ramps will provide handicap access at either of the two pair of large barn doors.

DIVISION 11: EQUIPMENT

None

DIVISION 12: FURNISHINGS

None

DIVISION 22: PLUMBING

22 1100 None

DIVISION 23: HEATING, VENTILATING, AND AIR CONDITIONING

23.0000 None

Ductwork below the floor at the weaving room is described under thermal and moisture protection.

DIVISION 26: ELECTRICAL



Wilder Homestead Barn, Circa 1798

26 0500 Provide electrical distribution throughout building for lighting and outlets at all areas.

Assume below grade entry, upgraded from existing extended from the farm house.

Provide one exterior outlet at of the four exterior walls

26 5600 Exterior Lighting

Provide building mounted exterior lighting. Assume 3 fixtures.



The Barn Kitchen/Toilets Addition — New Construction Outline Specification

PROJECT DESCRIPTION SUMMARY

Description of the Building

The existing garage addition is a hybrid post & beam, stick built structure, without a foundation or floor slab. The garage will be demolished, with the slate from the roof and exterior barnboard salvaged to use in the restoration of the barn.

The garage will be replaced by a new addition, with concrete foundation and floor slab, to house a catering kitchen, two toilets, and a janitor's closet. A new septic system will be required, although that is excluded from the pricing for the addition.

DIVISION 01: DEMOLITION

01 1000 Demolition and Salvage

The garage addition has no foundation, and is structurally at risk. The garage will be demolished in preparation for the barn restoration. The barnboard siding will be salvaged. The slate roof will be removed and salvaged.

DIVISION 03: CONCRETE

03 3000 Concrete

Provide new foundation walls to frost depth, with a 4 inch ledge to receive field stone to conceal the concrete at the 12 inches above grade exposed at the exterior.

Provide new slab on grade at floor. There is no basement. Suitable backfill to be provided for slab. Provide reinforcing as necessary.

DIVISION 04: MASONRY & STONE

04 4313 Stone Masonry Veneer

Provide field stone veneer at the perimeter foundation ledge to conceal the concrete foundation at the exterior.

DIVISION 05: METALS

05 0500 Common Work Results for Metals

Bridging, joist hangers, "Simpson" connectors, brackets, hurricane ties, etc.



05 1223 Structural Steel for Buildings

Miscellaneous structural steel, and concrete foundations reinforcing.

DIVISION 06: WOOD, PLASTICS, AND COMPOSITES

6 1000 Rough Carpentry

Provide dimension lumber framing for studs, rafters, and ceiling joists. Lintels, beams, and headers to be nominal framing lumber, or engineered wood. No post & beam framing is to be used for the addition.

06 0573 Preservative Wood Treatment

Provide pressure treated wood for sill plates.

Barnboard Siding

Provide a board foot count of pine barnboard for the entire outer layer of barnboard for the barn, with a wall height increase of 1 foot. Barnboard siding to be 1" x 10".

Provide a cost for the sawmill work.

6 1600 Sheathing

Sheathing to be exterior grade CDX plywood or OSB board.

06 0573 Preservative Wood Treatment

Provide pressure treated 2x8 wood base plates for sill plate timbers to rest on at all column lines, perimeter and interior. The interior girts will support a pine plank floor deck.

DIVISION 07: THERMAL AND MOISTURE PROTECTION

07 2100 Thermal and Sound Deadening Insulation

Exterior wall "Zip System" includes 5 1/2" high density fiberglass batt insulation.

Interior typical partition walls 3 5/8" batt sound insulation full height at toilets.

Above ceiling joists 18" fiberglass batt insulation.

Install rigid extruded foam boards (4" polystyrene) Dow Blueboard at foundation perimeter and under new slab.

8" diameter spiral metal ductwork, previously install with Phase 1, the barn restoration, will be supplied by the furnace provided in this phase. The propane fired furnace will be installed with this phase, Phase 2, when the kitchen/toilets addition is built.

DIVISION 8: OPENINGS



08 1416 Wood Doors

One "people door" is to be constructed with barnboard to match the siding to match the doors at the restored barn..

08 5213 Windows

The windows are to be single sash hopper, tilt in windows, to match existing at the barn.

08 7100 Door Hardware

The door hardware is to be forged in traditional styles, by a local blacksmith.

DIVISION 8: OPENINGS, CONTINUED

08 1416 Wood Interior Doors

Provide stile and rail wood doors, paint grade, at toilets and at janitor's closet.

08 7100 Door Hardware

Latch sets, hinges, stops in satin nickel finish. Use levers on all latch and lock sets. Schlage or equal.

DIVISION 9: FINISHES

09 2900 Gypsum Board

Use 5/8" regular gypsum board on designated interior walls and on all ceilings. 5/8" water resistant gypsum board in wet areas. Use Type X gypsum board on partitions requiring fire rating (furnace room).

FRP ,fiberglass reinforced panels, to be used at all walls in the kitchen, installed over water resistant gypsum board.

09 6516 Resilient Sheet Flooring

Provide single sheet resilient vinyl sheet Tarkett "Standard Plus" at all floor areas, applied directly onto concrete slab.

09 9123 Interior Painting

Latex semi-gloss paints on scheduled walls. Use paint on interior wood trim. Meet state volatile organic compound requirements.

DIVISION 10: SPECIALITIES

10 0000 Handicap Ramp

A permanent wooden handicap ramp with landing is to be provided at the entry door.

10 2800 Toilet, Bath, and Laundry Accessories

Stainless steel (satin finish) accessories including soap dispensers, towel dispensers, waste receptacles, toilet paper holders, grab bars, feminine



napkin dispensers and disposals, and framed glass mirrors. Bobrick and/or American Standard.

10 4400 Fire Protection Cabinets and Fire Extinguishers

Manual extinguishing equipment located in accordance with NFPA 10.
One at the kitchen.

DIVISION 11: EQUIPMENT

11 3013 Residential Appliances

Provide one 11 cu.ft. refrigerator, one microwave, one 30" oven/range combination, and one 24" dishwasher.

All appliances to be Energy Star.

Provide double bowl sink at kitchen .

Provide utility sink and mop sink in janitor closets.

DIVISION 12: FURNISHINGS

12 3530 Residential Casework

Kitchen cabinets and vanity cabinets shall be federal severe use grade construction.

12 3661.16 Solid Surfacing Countertops

Vanity countertops shall be solid surface with integral bowl.
ADA compliant.

DIVISION 22: PLUMBING

22 1100 Domestic Water Distribution

Provide new distribution. From existing farm house system, underground from approximately 40 yards away.

22 4200 Plumbing Fixtures

Low-flow type plumbing fixtures and related trim, fittings, and valves meeting ADA requirements.

DIVISION 23: HEATING, VENTILATING, AND AIR CONDITIONING

23.0000 Mechanical Heating and Cooling Systems

1. Gas fired forced air vertical fan-coil unit at utility closets to supply addition and weaving room at restored barn.

Ventilation

1. Ventilation shall be integral to the vertical fan-coil units. There will be no energy recovery units.



DIVISION 26: ELECTRICAL

26 0500 Provide electrical distribution throughout building.

Route electrical service directly into building. Assume below grade entry connected with farm house existing service.

Provide emergency lighting integrated with house light fixtures and exit signage.

Provide visual alarm/strobes for the hearing impaired in ADA restrooms.

Install hardwired smoke detectors and one carbon monoxide detector as required by code.

26 5100 Interior Lighting

Assume all rooms shall have overhead lighting.

Provide under cabinet kitchen lighting. Provide over vanity bathroom lighting.

Install breaker sub-panel.

Install GFI's in kitchens and baths as required.

Install all boxes and electrical outlet or switch devices and cover plates.

26 5100 Interior Lighting, continued

Install interior energy efficient LED lighting fixtures with lamps in each space.

Install energy efficient LED task lighting in kitchen.

Install emergency pack lights and lighted exit signs as required for exits and corridors.

26 5600 Exterior Lighting

Provide building mounted exterior lighting. Assume one (1) fixture at entry.

