Linden Grist Mill
Architectural Assessment Report
(Bridge Street/Broad Street Historic District)
City of Linden, Michigan

Prepared for:
City of Linden
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Introduction
John Dziurman Architects Ltd. is pleased to have the opportunity to provide the City of Linden this Architectural Assessment Report - for the Linden Grist Mill built in the mid1850s. The architectural assessment report provides the city an overview of the existing conditions of the structure; a visual assessment of the building materials; an analysis of the building physics relating to the peeling paint condition on the exterior cedar siding; recommendations to fix, restore or replace specific building materials; and a list of the recommended repairs and restoration items – prioritized in order of need, and an estimated cost for each repair listed. The recommendations are based on the building’s history, our research and knowledge of older and new building materials and technology, our understanding of your facility goals, and our commitment to preserve the design intent of the original builders of this historic mill.

All of our assessment findings and recommendations comply with the Secretary of the Interior’s Standards for Rehabilitation and the Guidelines for Rehabilitating Historic Buildings. Compliance with the Standards is required for historic resources listed on the National and State Register. John Dziurman AIA, NCARB is certified as a Historical Architect by the State Historic Preservation Office. His qualifications exceed the professional requirements for "Historic Architecture" as stated in 36CFR Part 61 in the Code of Federal Regulations to perform specific historical activities defined by the National Park Service.

Overview
Linden Grist Mill (Linden Mills-marker name) was constructed in 1850s. The building has a concrete and fieldstone foundation, an old growth oak timber frame structure, ½ "x 6" bevel cedar siding, and an asphalt shingled gable roof. The Mill was built into a hill adjacent to the mill pond. The 3 story north elevation faces the mill pond; the 2 ½ story east and west elevations have partial wall exposures of the first floor and a full exposure of the second and third floors, including the gable end roof; and the 2 story south elevation has full wall exposures of the second and third floors. This elevation also includes a full width raised covered entry porch with stairs and a barrier free ramp.

The building has three floor levels and a loft level, with a smaller footprint, above the third floor level. The footprint of the building is approximately 30 x 60 feet, and the total square footage is approximately 6,000 square feet.

The mill roof has four (4) cross gable dormers (two on the north elevation and two on south elevation). Each of the four dormers have one (2/2) double hung window topped with a two pane triangular shaped fixed window. The mill building has a total of 33 (6/6) double hung windows, one (6/9) double hung window, two (3/3) windows, two bay windows (one on the north and one on the east elevations) with three (3/3) windows in each bay.

The building has three floor levels and a loft level, with a smaller footprint, above the third floor level. The footprint of the building is approximately 30 x 60 feet, and the total square footage is approximately 6,000 square feet.

The grist mill continued to operate until 1956. Soon afterwards, it was purchased by the village for use as municipal offices and a future library. The municipal offices were relocated into the current City Hall about four years later and the former village offices in the mill were remodeled for a meeting room on the first floor and the Genesee County Library on the second floor. Other improvements at that time included installing new exterior doors and windows (including two bay windows) and replacing almost all of the original cedar siding with new cedar siding. On October 23, 1961 the mill reopened and became the community center. Fifteen years later in May 1976, work began on building a stairway to the third floor of the Mill. Grants were obtained from various organizations and the Linden Mills Historical Society Museum opened in August of 1976. In 1995, the mill’s exterior
bevel cedar siding was restored and painted. In 2012, Linden Mills Historical Society Museum became barrier free, after grants were obtained from various organizations and they were able to purchase and install two barrier free chairlifts for handicap access to both third and fourth levels.

**Architectural Assessment Work Plan**

Our work plan included the following tasks:

1. Visual walk-thru assessments of the existing building;
2. Investigation of causes for the paint failure on the exterior wood siding;
3. Identify problems relating to building systems, materials, finishes, and safety issues;
4. Recommendations to correct the exterior wood siding paint problems; and
5. A final architectural assessment report with summary of services provided, analysis of the problems identified; list of the repairs and restoration needed – prioritized in order of importance with a preliminary estimated cost for item listed.

To adequately assess the mill, we visited the site and building twice; reviewed the files of the previous repairs and upgrades; verified the species of the exterior wood siding; reviewed the existing construction; contacted local individuals and companies familiar with or who have worked on previous mill projects; and meetings and discussions with Paul Zelenak- City Manager; Jason Payne – City Building Official; Barbara Kincaid, Museum Curator- Linden Mills Historical Society Museum; George Loyer- resident, semi-retired manager and estimator for Michigan Lumber Co.; architect Ronald Campbell, Oakland County historical architect, formerly with THA and project manager for 1995 paint project for the mill; Stephanie Rose - manager Sherwin-Williams Company and a number of paint contractors and manufacturer representatives for paint and wood products.

**Mill repairs and upgrades 1995 – 2012**

The following is a summary of maintenance and improvements from 1995 – 2012.

- **1995** – Restored exterior siding and paint: $59,500 including architect’s fee and contractor’s cost and materials.
  - Exterior cedar siding – repaired and replaced damaged siding
  - Preparation and painting - Peeling paint hand scraped and hand painted
  - Prior to starting this work, the fire department used high pressure hoses to clean and remove the peeling paint. Unfortunately, the hose water (aimed up) resulted in entering the building and caused a mess on the inside and damaged the integrity of the cedar wood siding.
  - The paint products (primer and paint) were common house paint and primer by Sherwin-Williams – not “Duration” or other long lasting coating.

- **2000** – Fire Suppression/Sprinkler System installed: $25,300
  - Included all three floors and loft area.

- **2006** – Foundation, cement work, and masonry repairs: $10,105
  - Tuck-point west side, plaster east side, 700 sq. ft. of flatwork and precast concrete steps.

- **2009** – Roof replaced: $48,754
  - CertainTeed Landmark asphalt shingles limited 30 years warranty.
  - Prior to this work, the City spent under $10,000 to repair minor problems.

- **2012** - Two barrier free chairlifts installed: $8,815
  - Installed two stair-lifts to provide handicapped access between the second and third floors and the third floor and the loft floor level.
Visual Walk-Thru Assessment - Existing Conditions

- Building Foundations:
  a. Concrete Foundation
     i. North concrete foundation wall - Fair to Poor condition
        1. Recommend patching and/or replacement of foundation wall and at northwest and northeast corners - within one year.
     ii. East and west foundation walls and ramp/stair access to river - Poor condition and safety hazard.
        1. Recommend restoration – within 6 months
  b. Fieldstone Foundation – east, south and west walls
     i. East, south and west foundation walls - Marginal to poor condition
        1. Recommend - cleaning, repointing and patching - within one year
  c. Masonry Block Retaining Wall
     i. South wall from east to west – very poor condition
        1. Recommend - complete restoration – within 6 months
  d. Exterior wood stair
     i. Southwest corner from 1st to 2nd floor level – fair to poor condition
        1. Recommend - patching and repainting - within one year.
        2. Some deterioration might relate to applying the wrong ice melt.
     ii. Northeast corner from 1st to 2nd floor level – replacement condition
        1. Recommend - complete replacement – within one year
        2. Some of the deterioration observed might be due to applying the wrong ice melt.

- Concrete porch- south elevation
  a. It is our understanding - the concrete porch repairs are scheduled for this year.
  b. Based on our review of the 2006 work tasks for this porch, there was a significant amount of restoration work relating to the concrete porch and sidewalks. It appears that some of the deterioration observed might be related to applying the wrong ice melt or applying it on concrete less than 12 months old. Newly poured concrete also needs time to cure and settle. Applying an ice melt can weaken the concrete and make it more susceptible to failure. More information on this topic is provided in the recommendation section on pages 16 and 17.

- Structure
  a. All visible old growth oak timber framing, wood joists and framing appear to be in good condition on 1st and 2nd floor levels.
  b. On the third floor and the loft level, the original oak timber framing, wood joist and wood framing are exposed and appear to be in good condition.
  c. The oak timber roof framing and roof sheathing boards (used for installing the original cedar shingles) have been modified with fir insert wood strips to eliminate open gaps between each sheathing board.
  d. Also, there are some visible ceiling water stains – visible above the loft.

- Walls and Roof
  a. Exterior wall siding:½” x 6” bevel cedar siding
     i. The bevel cedar siding located at the top of the building, have thicker edges on the bottom of the siding, then those located lower on the wall.
     ii. The bevel cedar siding was last cleaned and painted in 1995. According to the city files and our conversation with the architect of record, the specifications and work tasks they provided were appropriate. Although, there is no visual evidence of the oil based prime coat being applied.
Concrete Foundation - Fair to poor condition

Recommend - above and below water structural investigation of concrete foundation condition.

Concrete drainage and water access structure at northwest corner is deteriorating.

Foundation at northwest corner

Concrete structure is deteriorating

Wood landing and stairs are not safe for emergency egress

Emergency egress door for first floor east exit
Fieldstone Foundation and Masonry Block Retaining Wall - marginal to very poor condition

Entry door to City Meeting Room on first floor.

Exposed electrical line - with rusted conduit needs to be replaced as soon as possible.

Wood stairway provides access down to first floor from parking lot.

Wood stairway needs repairs and repainting.

Fieldstone foundation is in marginal to poor condition.

Wood support posts are deteriorating and need to be replaced.

Retaining wall - Concrete Cap and Masonry Blocks are deteriorating and need to be replaced.

Fieldstone requires repointing, in fill stones and cleaning.

East Fieldstone Foundation - Marginal to Poor Condition

West Fieldstone Foundation - Marginal to Poor Condition

South Masonry Block Retaining Wall - Very Poor condition
South Concrete Porch - Very poor condition

Handicap ramp at main entry needs to be removed and replaced with an appropriate structural design, an appropriate selection of materials and a maintenance plan for materials and ice melting use.

Raised Entry Porch structure consists of concrete blocks set on the ground, wood beams (some cracked and broken) supporting concrete slab porch.

Main entry stair, ramp and porch show the deteriorating materials - concrete slabs, masonry block foundations, wood structural framing, rusting steel railings, pitted and cracked cement sidewalks.

Space between concrete stairs and fieldstone foundation for Grist Mill structure. Notice the wood beam sitting directly on grade within a water drainage trough, the rusted railing and the deteriorating concrete steps.
iii. Typically, painted wood siding can provide coverage protection for 10 - 15 years, depending on exposure to the environment and mechanics of the building. Since the previous paint application was over 20 years ago, the peeling paint could be simply a lack of an annual maintenance program.

iv. Typically, a solid stained finish on wood siding can provide coverage protection for 5 - 8 years and a semi-transparent stained finish on wood siding can provide protection for 3 - 5 years.

v. Based on our assessment and a conversation with the architect of record, local residents, and city files – the fire department in 1995 used high pressure water hoses to clean and remove the peeling paint. That action resulted in damage to the cedar wood fibers of the siding and also caused etching damage on the face of the siding.

vi. Observed wall conditions for each elevation relating to:
   a. Percentage of peeling paint surface
   b. Condition from exposure to climate and sun
      • Climate – rain, snow, wind, etc.
      • Sunlight - ultraviolet light paint surface damage
   c. Percentage of wall exposure

   **North Wall:**
   • Percentage of peeling paint surface - +/- 5%,
   • Climate – harsh conditions
   • Sunlight – least amount of sunshine
   • Percentage of wall exposure – 100%

   **East Wall:**
   • Percentage of peeling paint surface - +/- 50%,
   • Climate – neutral condition
   • Sunlight – morning sunshine only – second least to north
   • Percentage of wall exposure – +/- 75%
      • More wall exposure with gable end of roof

   **South wall:**
   • Percentage of peeling paint surface - +/- 25%,
   • Climate – damaging conditions - if not shaded
   • Sunlight – most amount of sunshine
      • Porch roof over entire 2nd floor elevation –
         No peeling paint on wall under porch roof
      • Roof overhang across entire elevation -
         No peeling paint on wall under overhang
   • Percentage of wall exposure – 75%

   **West wall:**
   • Percentage of peeling paint surface - +/- 75%,
   • Climate – damaging condition
   • Sunlight - most harsh sunshine
   • Percentage of wall exposure 100%
      • More wall exposure with gable end of roof

vii. Based on these observations, the peeling paint can also be related to the environment (temperature and moisture) and direct damage exposure from sunlight.

viii. The north elevation of the mill has the least amount of peeling paint, the least amount of sunlight, and the harshest weather conditions.

ix. The remaining assessment identifies addition items that need to be addressed before repainting and/or staining the siding.
North and South Wall Conditions and Features

**North Wall**
- Percentage of peeling paint surface: +/- 5%
- Climate: Harsh conditions
- Sunlight: Least amount of sunlight
- Percentage of wall exposure: 100%

**South Wall**
- Percentage of peeling paint surface: 25%
- Climate: Damaging conditions - if not shaded
- Sunshine: Most amount of sunshine
  - Porch roof shades entire second floor - no peeling paint
  - Roof overhang across entire elevation - no peeling paint
- Percentage of wall exposure: 75%
East and West Wall Conditions and Features

**East Wall**
- Percentage of peeling paint surface: 50%
- Climate: Harsh condition
- Sunshine: Morning sunshine only
- Percentage of wall exposure: 75%
- More wall exposure with gable end

**West Wall**
- Percentage of peeling paint surface: +/- 75%
- Climate: Damaging conditions
- Sunlight: Most harsh sunlight
- Percentage of wall exposure: 100%
Mill Roof

x. The gable roof of the Linden Grist Mill has four (4) triangular shaped dormers - two dormers on both the river and street sides. Each dormer has one (2/2) double hung window topped with a two pane triangular shaped fixed window. Normally, dormers are installed to provide additional head room for a room under a sloping roof. These dormers were installed to provide natural light into the third floor.

xi. In 2009, two layers of old shingles were removed. CertainTeed Landmark ‘Moiré black’ asphalt shingles were applied over sheathing covered with 15-lb. felt underlayment and six (6) feet wide sheets of ice and water shield at bottom. The shingle installation has a limited 30 years warranty.

xii. The present six (6) year old roof installation appears to be in good condition and there is no evidence of any roof leakage under the exposed structure on the third and fourth floors levels.

xiii. Approximately, 50% of the roof fascia, the overhang and eave soffits requires repair and some material replacement. There is also visual evidence of mold under the roof overhang.

xiv. All four dormers required repair and repainting.

xv. There are no gutters/downspouts for proper roof drainage.

xvi. There is no roof or wall insulation visible on the interior exposed areas of the third floor level and the fourth loft level.

xvii. There is no roof ventilation system.

xviii. It is our understanding that during winter the snow on the roof melts quickly and there is no ice damming anywhere along the roof edge.

b. Porch Roof

i. The porch roof requires repainting, gutter repair/replacement and flashing repairs.

ii. There is no ventilation system for the porch roof structure enclosure.

iii. The porch roof has a gutter mounted along the length of the porch and a downspout mounted on the structural post at the west end. The one downspout appears to dump the roof rainwater somewhere under the porch – which may or may not be properly drained. The porch roof gutter is damaged at the middle of the porch and approximately 10 feet toward the west end.

iv. The porch roof is approximately 50 feet wide with a structural post at each end. A 50 foot long roof with only a structural post at each end does not seem sufficient for the weight and length of this roof. Based on our observation, the roof appears to have some horizontal slag in the middle of the roof. A structural engineer needs to verify the structural condition and design load of the roof, and if the existing porch roof structure is sufficient for the design load.

• Windows, doors, and moisture barriers

a. All the exterior windows need some type of repair and repainting.

b. All exterior window wood trim and sills need some repainting and repairs.

c. The interior condition of the windows, appear to be in good condition.

d. All the exterior doors need some type of repair and repainting, threshold cleaning, flashing review and hardware review.

e. All exterior door trim need some repair and repainting.

f. When the first and second floor levels were remodeled for the city and library use, the exterior walls would normally be updated by installing wood stud framing between the exterior wall timber framing, adding blanket insulation between the wood stud framing in the walls, installing drywall on the interior and applying a paint finish. According to city staff, no vapor barriers were installed on the inside face of these walls.

g. The third floor level was remodeling in May 1976, when a wider stairway was installed to the third floor and the Linden Mills Historical Society establish a local museum. The LMHS also constructed a fourth loft level for additional display and work space.
Inside the Mill

First Floor

City Meeting / Conference Room

Second Floor

Genesee County Library - book stacks and exposed timber framing

Northeast corner Storage Room

Egress Code Violations and Life Safety Issues

Looking up into utility space above ceiling and below second floor

Librarian Work Area - North Bay Window and exposed timber framing

Exposed sprinkler system, book stacks and timber framing
Linden Grist Mill Assessment Report

Inside the Mill
Third Floor

Linden Mills Historical Society Museum
Interior walls covered with wood boards

Loft Floor

Loft Floor
Looking east at exposed timber framing
And roof structure without insulation

Roof sheathing boards with fir insert strips
to eliminate original open gaps

Stairway to fourth floor Loft with
exposed timber framing and utilities

Looking down from the Loft stairway
at the third floor wood flooring and framing

The Loft stairway with Stair-Lift and open roof
structure without insulation and ventilation system
h. Barrier free access to the museum was accomplished in 2012, when grants were obtained from various organizations and the LMHS was able to purchase and install two barrier free chairlifts for handicap access to both upper levels.

i. Moisture Barriers

i. There is no visual indication of any vapor or moisture barriers installed under the roof and/or on inside of the exterior walls of the upper levels of the mill

ii. Also, the wood siding was never backed or edge primed, prior to attaching the boards to the exterior walls and painting the exterior siding.

City of Linden Building Department

- Jason Payne, Building Official
  Tel: (810) 735-7980
  E-mail: building@lindenmi.us

a. Applications for building permits:

i. Separate applications from the State of Michigan must be completed for plumbing, mechanical, and electrical work permits.

ii. The City of Linden does not process these types of applications or perform inspections for this work.

iii. Building Department for the City of Linden provides all other applications, forms and inspections.

b. Building Codes relating to the Linden Mills

i. Michigan Rehabilitation Code for Existing Buildings

ii. BOCA National Building Code - Chapter 34 – Existing Structures

1. Fire Suppression/Sprinkler System - yes
2. Alarm System - yes
3. Alterations – Level 2 and 3

4. Table 503 Height and Area Limitations of Building

a. Height and Area Limitations of Buildings
b. Use Group A-3 Assembly
c. Type 3 or Type 4 Construction Protected 3A or 4
d. Allowable height - 3 stories (40 feet) & 11,550 – 12,600 Sf. / floor
e. Allowable height with automatic sprinkler system – 4 stories (Museum Loft/Mezzanine) and 60 feet

5. Zoning

a. CBD: Central Business District
Findings
Tight Building or Historically Accurate and Leaky

The first mill, located on the land granted to Consider Warner, was used to cut lumber. From 1845-1850 Seth Sadler and Samuel W. Warren, local residents, erected both a saw and grist mill. Operating along with the earlier facility, this complex was called the Linden Mills. The Linden Grist Mill is the last remaining mill of the Linden Mills.

Based on our assessment findings, the Linden Grist Mill lacks many of the current code and conventional building systems needed to control condensation, indoor-air-quality, mold, and rot and energy efficiency. The mill does not have any natural ventilation systems, moisture barriers or insulation for the roof; and does not have sufficient insulation or any vapor barriers for the exterior walls.

A tight building is better than a leaky building, with a caveat: A tight building without a ventilation system is just as bad as a leaky building with no ventilation system – maybe worse. Energy efficiency requires a tight shell; and good indoor-air–quality requires fresh outdoor air. Ideally, the fresh air should come not from random accidental leaks of unknown size and quantity, but from a known source at a known rate. For this to happen, the building would need to have an adequate air barrier and a controlled ventilation path.

In a leaky building, large volumes of air – driven by exhaust fans, the stack effect, and wind – can blow through the floor, walls, and ceiling. Because air usually contains water vapor, these uncontrolled air leaks can cause condensation, mold and rot.

Older buildings rarely had condensation problems in cold weather because they were leaky. The relative humidity in old buildings rarely rose above 25% during the winter. As tighter buildings have been built with inadequate or nonexistent mechanical ventilation, the indoor relative humidity (RH) has gone up. In a tight non-ventilated building, the amount of moisture in the air is dramatically different from that in an older leaky building. Condensation occurs wherever water vapor can find a cold spot: on the roof or wall sheathing, on the inside faces of the windows, and inside enclosed walls.

In summer, the same phenomenon can happen in reverse. When hot, humid outdoor air (85 degrees F, 75% RH) leaks inside, the moisture in the air condenses when it hits a surface below 76 degrees F - for example, on plastic sheet vapor barriers cooled by air conditioning.

In a tight building with a good air barrier and a supply-only ventilation system, most of the air that’s drawn inside comes through the air conditioner and the first cold surfaces it sees are the cooling coils.

If you have air leaks in the building envelope, you usually can’t see the condensation-unless you start cutting holes in walls. However, condensation is sometimes easily visible in the attic; all you have to do is look for frost or dampness forming on the underside of the OSB or plywood roof sheathing. It doesn’t take much of a hole in the ceiling of a humid building for condensation to accumulate as frost. Then when the sun warms up the black shingle roof, the frost melts, the water falls, and you assume that you have a roof leak.

Air that leaks through your walls, windows, roof, or basement can result in nothing but trouble. Building tight and ventilating right usually is the best option - or is it?

The Linden Grist Mill (an older building) was constructed by individuals who knew how to build saw mills and grist mills – basically a factory and workshop. In the 1850s the ventilation system and moisture control were the cracks in the building shell (a leaky building). The exterior building
components of an older building, such as roofs, walls, openings, projections, and foundations, were often constructed with a variety of functional features. Such as, overhangs, trim pieces, drip edges, and milk paint (applied on the exterior walls), to protect against water infiltration, ultraviolet deterioration, air infiltration, and pest infestation. Construction assemblies and joints between materials allowed for expansion and contraction and the diffusion of moisture vapor, while keeping water from penetrating the building envelope. Older buildings used all of these functional features effectively and care should be taken to retain them, avoiding the temptation to reduce air infiltration or otherwise altering them. The historic Linden Grist Mill has retained most of its character defining features that contribute to why this building is designated as an important local historic resource in both the national and state registry of historic places.

The interiors of the mill have been remodeled into a conference room for the city on the first floor and a library for the community on the second floor. Both of these floors have heating and air conditioning. The third floor interior basically remains the same as the mill looked in the 1850s. The Linden Mills Historical Society Museum location on the third floor and their decision to retain the original interior is both historically correct and functionally correct for a leaky building - accidentally or not. As noted previously, older buildings rarely had condensation problems in cold weather because they were so leaky. In summer, the same phenomenon can happen in reverse. Interestingly, the third floor is heated in the winter and does not have air conditioning in the summer. Because of this situation, the building roof and walls have not had any major problems with condensation, indoor-air-quality, mold or rot. But, if this situation changes, the city will need to consider - building tight and ventilating right or keep it historically accurate and functionally leaky on the third floor.

Peeling Paint - Cedar Siding
Establish a Maintenance Program for the Mill
In 1995, the paint on the exterior cedar siding was peeling. The city hired an architect and a contractor to restore and repaint the mill. In 2015, the paint on the exterior cedar siding was peeling again. Based on our review of the architect's specification from the 1995 paint project, the written instructions appear to be appropriate. Also, every paint manufacturer provides information for preparation procedures, application procedures and maintenance procedures. The required maintenance timeframe for painted cedar siding is approximately 5-8 years. The life of the paint is approximately 10-15 years, depending on exposure to the environment and mechanics of the building. Therefore, it is possible that the peeling paint applied in 1995 could be directly related to not having an established annual maintenance program, which would require a visual inspection of the exterior wall condition every year, and repair whatever is needed before it becomes a larger problem.

Building Systems to Control Condensation
Peeling paint can also be related to one or more issues and/or problems. Most of these items have been previously identified. Other harmful conditions include:

- Wood was wet when it was painted
- Unfinished siding was exposed to several weeks of sunlight before painting
- Temperature was too cold when wood was painted.
- Wood was too hot when it was painted or was heated soon after painting.
- Weather was too humid when the surface was painted.
- Humidity in the mill was too high during the heating season.
- Wood was installed directly over foam or foil-faced insulation board.
- Mill has no interior vapor barrier.
- Wood siding was dirty when painted
- Wood had mill glaze when painted
- Brown stains appear on the surface of the paint.
- Wood has decayed (rotted) on the inside.
Solid-Color Stain versus Paint for Cedar Siding

If the mechanics of the building are not in good order (ventilation, gutters, damp basements, roof, etc.) and they will never be in good order - then stain has an advantage in that it will allow moisture to travel through the exterior wall without causing finish coating failure. Paint can provide protection for 10-15 years depending on exposure to sun and building mechanics, whereas stains will last 5-8 years. Solid-color stain requires less prep work when it comes time to re-stain, but if you paint before failure there is also less prep work. Ideally, all the siding should be backed primed and all cut ends should be sealed, before application of the coating (stain or paint).

Preparation prior to applying coatings
Scrape off all the peeling paint, sand the remaining paint to a feather edge with 60-grit sand paper, kill the mildew on the old paint with a mixture of diluted bleach and dish soap, then rinse thoroughly. Where the bare wood is dry, remove the decayed layer with 80-grit sand paper. Take care not to over-sand and cause a dish-like impression in the siding. To ensure the surface is dust-free, wipe the prepped area twice with denatured alcohol and clean cloths, followed with either coating option 1 or option 2

- Coating Option 1 – Solid Wood Stain
  - Two coats of solid wood stain as per manufacturer’s instructions
- Coating Option 2 - Paint
  - One coat of an oil-based primer, such as Exterior Oil-Based Wood Primer (SW-Y24W8020) or Cover-Stain (rustoleum.com).
  - Wait about four (4) hours, than brush on the top finish coat with 100% acrylic paint, such as SW Duration Exterior Acrylic Satin K33-200 Series - as per manufacturer’s instructions
  - Next spring, if the new paint peels despite all the preparation - moisture migration is the problem, which will need to be eliminated before repainting.

Recommendation
We recommend staining the wood siding with a solid color stain. Staining will last 5-8 years before it requires a re-application. Staining also requires less prep work when it comes time to re-stain. It is also important to schedule an annual maintenance program (together with a maintenance budget) every year.

Concrete porch and sidewalk deterioration
Deterioration relating to the use of Ice-Melt
Based on our review of the previous work tasks in 2006 relating to the concrete porch and sidewalks, it appears that some of the deterioration observed might be due to applying the wrong ice melt or applying it on concrete that’s less than 12 months old. Newly poured concrete needs time to cure and settle. Applying an ice melt can weaken the concrete and make it more susceptible to future damage.

Opt for sand or gravel to add traction instead of ice melt. Most of the damage to paved surfaces is caused by using too much ice melt and, especially for concrete, the freeze/thaw cycle that they’re subjected to. Follow the instructions on the packaging for the application amount. If you're concerned about surface damage and want to increase traction on your sidewalks, consider other options, such as kitty litter, sand, or sawdust.

Magnesium in any form, especially magnesium chloride, is very damaging to concrete, and concrete can become unstable after the corrosiveness in chloride-based ice melts eats away at the rebar.

Similarly, acetate ice melts can cause asphalt pavements to strip easily, breaking the bond between the aggregate and the asphalt binder.
## ICE-MELT COMPARISON

<table>
<thead>
<tr>
<th>Effective temp.</th>
<th>Asphalt/concrete damage</th>
<th>Best for</th>
<th>Benefits</th>
<th>Precaution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25° F</td>
<td>Minimal to moderate</td>
<td>Those in a time crunch</td>
<td>More effective than sodium chloride; Fast acting</td>
<td>Can damage grass and plants when overapplied</td>
</tr>
<tr>
<td>20° F</td>
<td>Moderate</td>
<td>Contractors</td>
<td>Environmentally friendly; Less corrosive than chloride products</td>
<td>Can damage concrete</td>
</tr>
<tr>
<td>-13° F</td>
<td>Moderate to significant</td>
<td>Pet owners, Gardeners; Those in a time crunch</td>
<td>Environmentally friendly; Safer around pets</td>
<td>Can damage plants when overapplied; Lethal to pets that suffer from kidney disease if ingested</td>
</tr>
<tr>
<td>25° F</td>
<td>Minimal to moderate</td>
<td>Pet owners, Gardeners</td>
<td>Environmentally friendly; Safer around pets</td>
<td>Can damage grass and plants when overapplied; Lethal to pets that suffer from kidney disease if ingested</td>
</tr>
<tr>
<td>20° F</td>
<td>Minimal to moderate</td>
<td>Bargain hunters</td>
<td>Inexpensive</td>
<td>Can damage asphalt, concrete, brick, stone, metal, grass, plants, and wood decks. Don’t use on concrete less than 1 year old. Lethal to pets if ingested</td>
</tr>
<tr>
<td>10° F; better at 25° to 30° F</td>
<td>Minimal (almost nonexistent)</td>
<td>Pet owners, Gardeners</td>
<td>Environmentally friendly; Safer around pets</td>
<td>Can damage plants when overapplied; Not very effective as deicer</td>
</tr>
</tbody>
</table>

*Price per 50-lb. bag*
Recommendations / Estimated Costs and Priority

Establish A Maintenance Program For The Mill........................................City of Linden
- Initiate a semi-annual maintenance program

Tight Building Or Historically Accurate And Leaky..................................City of Linden
- We recommend maintaining the mill, historically accurate and functionally leaky

1. First Floor - East Exit Door and Exterior Wood Stairway......................$5,000 - $8,000
- Comply with Means of Egress Codes – inside and out
- Remove all storage items within exit pathway
- Restore Ramp/Stair Access to River

2. Remove Peeling Paint, Stain Siding and all wood items.......................$80,000 - $95,000
- Preparation
- Application - two coats of solid wood stain
- (see instructions on page 9).

3. Building Foundations, Retaining Walls and Stairs.................................$44,000 - $107,000
- Concrete Foundations
  - North Wall Deterioration $25,000 - $75,000
  - Structural engineer-report $3,500 - $5,000
  - East and West foundation walls $7,500 - $15,000
- Fieldstone Foundation $3,000 - $4,500
- Masonry Block Retaining Wall $5,000 - $7,500

2. Concrete Porch - south elevation......................................................City of Linden
- Porch repairs scheduled for 2015.

3. Mill Roof Repairs..............................................................................$35,000 - $45,000
- Roof Fascia, Overhangs, Eave Soffits,
  Material Replacement and Remove
  Mold under Overhangs (approximately 50%)
- Four (4) Dormers

4. Porch Roof Repairs..........................................................................$4,500 - $8,500
- Repairs, Repainting, Gutters and Flashing
- Ventilation for Porch Roof
- Structural engineer - design and roof load

5. Windows and Doors Repair and Repainting........................................$15,000 - $25,000
- Exterior Windows
- Wood Trim and Sills
- Exterior Doors
- Threshold, Flashing and Hardware

Total Preliminary Construction Costs = ......................................................$183,500 - $288,500

Total Project Costs
In addition to the preliminary construction cost estimate listed above, the City should budget funds to cover other project related costs such as: 1) job site contingencies; 2) legal and accounting fees; 3) reproduction of documents; 4) costs associated with bidding and awarding the construction contracts; and 5) professional fees.

Generally, total project cost is approximately equal to the sum of total construction cost times a multiplier of between 1.25-1.45, for this type of project. Using 1.25 as the multiplier,

Total Project Cost = ............................................................................$229,375 - $360,625

All estimated construction and total project costs are stated in 2015 dollars.
Informational documents related to this Report

The Secretary of the Interior's Standards for Rehabilitation

The Standards (Department of Interior regulations, 36 CFR 67) pertain to historic buildings of all materials, construction types, sizes, and occupancy and encompass the exterior and the interior, related landscape features and the building's site and environment as well as attached, adjacent, or related new construction. The Standards are to be applied to specific rehabilitation projects in a reasonable manner, taking into consideration economic and technical feasibility.

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterizes a property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

Source: [http://www.nps.gov/tps/standards/rehabilitation.htm](http://www.nps.gov/tps/standards/rehabilitation.htm)
Preservation Briefs #10 – Exterior Paint Problems on Historic Woodwork,
http://www.nps.gov/tps/how-to-preserve/briefs/10-paint-problems.htm

Preservation Brief #10 provides information relating to common types of paint surface conditions, failures and recommending appropriate treatments for repainting to assure the best adhesion and the greatest durability of the new paint. In all cases, the information is intended to address the concerns related to exterior wood siding on historic buildings.

The recommendations outlined in this Brief are cautious because at present there is no completely safe and effective method of removing old paint from exterior woodwork. This has necessarily eliminated descriptions of several methods still in a developmental or experimental stage, which can therefore neither be recommended nor precluded from future recommendation. With the ever-increasing number of buildings being rehabilitated, however, paint removal technology should be stimulated and, in consequence, existing methods refined and new methods developed which will respect both the historic wood and the health and safety of the operator.

Future Options/Considerations

Preservation Brief 43 - The Preparation and Use of Historic Structure Reports
http://www.nps.gov/tps/how-to-preserve/briefs/43-historic-structure-reports.htm

A Rehabilitation / Preservation Master Plan (also called Historic Structure Report) provides documentary, graphic, and physical information about a property's history and existing condition. Broadly recognized as an effective part of preservation planning, a historic structure report also addresses management or owner goals for the use or re-use of the property. It provides a thoughtfully considered argument for selecting the most appropriate approach to treatment, prior to the commencement of work, and outlines a scope of recommended work. The report serves as an important guide for all changes made to a historic property during a project-repair, rehabilitation, or restoration-and can also provide information for maintenance procedures. Finally, it records the findings of research and investigation, as well as the processes of physical work, for future researchers.