

February 14, 2023

## **Heritage Conservation Management Plan – Roof, Masonry Walls, Wood Doors and Trims, Mechanical Systems at Macewan House, Riverwood, Mississauga ON**

### **1. Introduction**

-An executive summary of the scope of the project:

*The proposal is to do conservation work on the exterior of the building including replacing deteriorated asphalt roof shingles and associated flashings/trims, repointing of deteriorated stone walls, removal of some clay brick fragments in the stone walls and replacement with new stone pieces, and painting and re-caulking of existing wood doors and frames where required. There will be some repair of disturbed thermal insulation in the attic and provision of baffles between the existing rafters to ensure proper roof ventilation. There will be replacement of the building mechanical systems with new energy efficient equipment (work generally limited to the existing mechanical room). This will not affect the exterior of the building except for the provision of a new exhaust and intake vent and the provision of new concrete slabs to support new exterior condensing units adjacent to the building. In general the exterior changes to the building are minimal and only as required to maintain effective ongoing maintenance.*

-Engineering and other reports

*The scope of work did not require structural engineering review. The building was inspected on several occasions by Hitesh Khatri, OAA Architect and Rick Mateljan Lic Tech OAA CAHP, Heritage Consultant accompanied by City staff. An extensive examination of the roof was carried out by personnel from Royal York Roofing. HVAC replacement has been designed and will be reviewed by J. Dasgupta P. Eng.*

-Background information to document the historical and development history of the site

*This site has been researched and documented and Macewan house is designated under Part IV of the Ontario Heritage Act. Information about the property is available here: [HistoricPlaces.ca](https://historicplaces.ca) - [HistoricPlaces.ca](https://historicplaces.ca)*

- Identification of the property owner and stakeholders, current and proposed use

*The property is currently owned by the City of Mississauga and functions as a public park in partnership with the Mississauga Garden Council and Visual Arts Mississauga. Macewan house is used for a variety of activities including children's programming, etc. The basement is used by the City of Mississauga as offices. The building is no longer a functioning residential home. These uses are proposed to continue.*

## 2. Project Description

### Property Description:

- Identify the location, municipal address and provide an appropriate location map

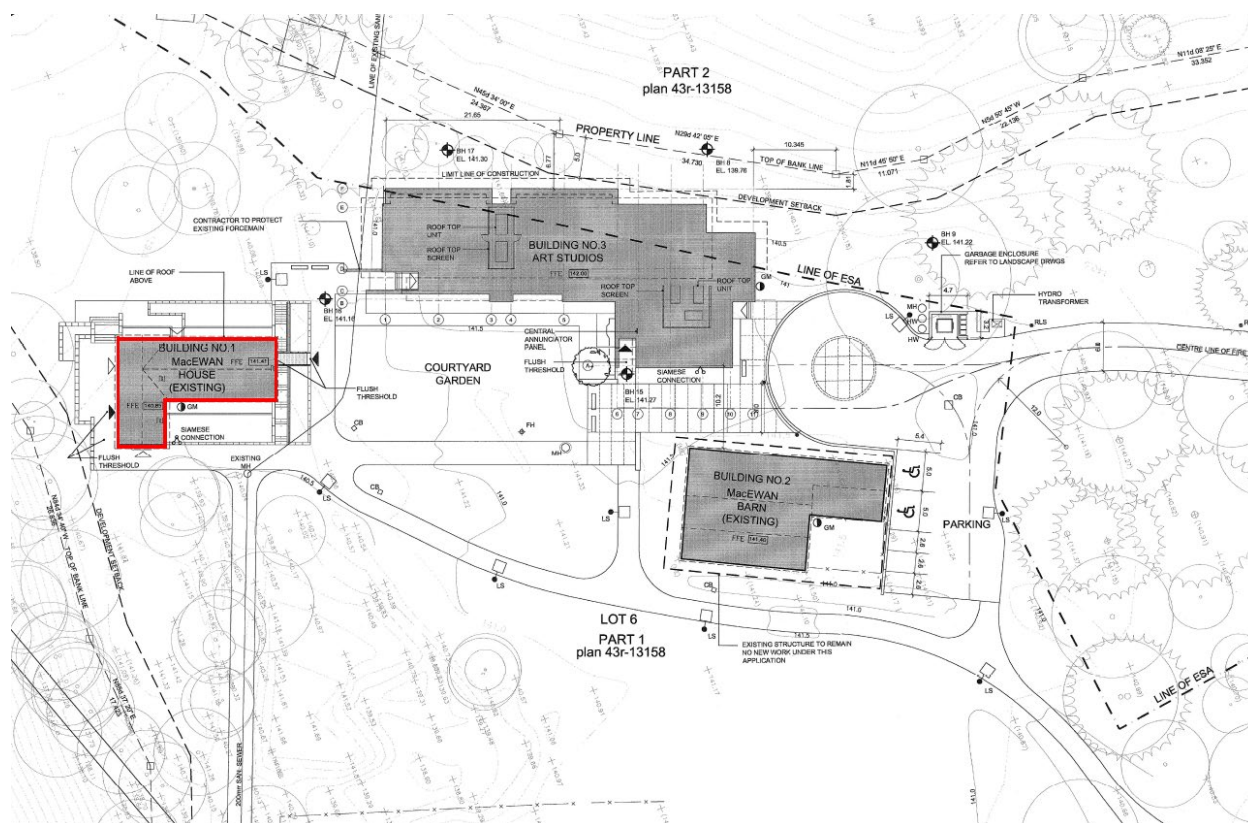
*4190 Riverwood Park Lane, Mississauga, Ontario L5C 2S7*

- Documentation of the existing conditions to include recent specialized photograph documentation, measured drawings, site plan, identification of site features such as topography, landscaping or other on-site features

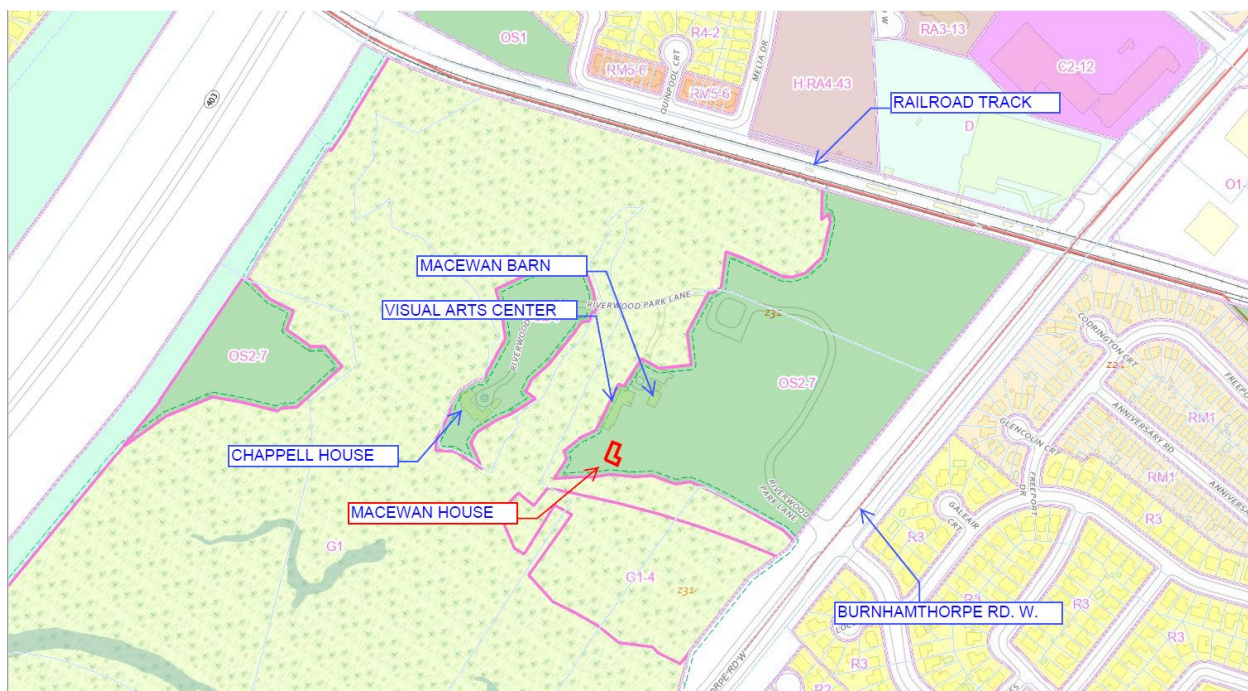
*See attached architectural drawings.*

- Landscape inventory and documentation will include a site plan, views and vistas, water features, tree location and species, land forms, geological formations, fences, walls, berms, pathways, or any other landscape features

*The building is bordered to the west and south by natural forest and to the north and east by artificial landscaping appropriate to its use as a community facility requiring barrier-free access. No changes to the exterior landscaping are proposed, and there will be no impact on any natural or man-made natural features.*



- Identification of neighbouring properties, including any built form or features, required to illustrate the context of the subject property



*Macewan house is located in a stable community park setting. To the east, west and south are single family dwellings. To the north is Highway 403. The subject building is one of a group of three buildings, the others being the Part IV designated Macewan Barn and a contemporary building called the Visual Arts Mississauga. These buildings are not visible from the street and only minimally visible from the nearby Riverwood Park Lane. It is necessary to walk from the parking area to see it. Other major buildings, most notably the Chappell House, are located on the Riverwood property but at some distance from the subject site. Overall the park is highly treed with a mix of natural and cultivated landscape features.*

- Summary of the history of the property outlining its development over time within a timeframe context
- Documentation of land ownership from the original Crown Grant and subsequent records from the land registry office

*The history of Riverwood has been extensively researched and documented and is available on the Riverwood Conservancy and City of Mississauga websites. This history does not have to be repeated for this document.*

#### B) Significance:

- Statement of cultural heritage value or interest

*The building was designated under City of Mississauga By-law 505-2004 although there is no designation statement.*

- Identification of the cultural heritage attributes and values of the property structures and landscape features

From “Canada’s Historic Places”:

*“-vernacular style of the MacEwan House, with its stone construction, pitched roof and concrete basement floor”*

- Identification of any recognized significance, such as a heritage designation by-law, historic plaque, etc.

*The property is Designated under Part IV of the Ontario Heritage Act and functions as a part of a park and interpretive center. It is highly recognized as a heritage and natural resource within the City of Mississauga.*

#### C) Planning and Policy Status:

- Provide details of the current land use and related Official Plan policies and Zoning

*The property is zoned OS2-7 under the Mississauga Zoning By-law 0225-2007. This is a zone that allows only a City Park with active and passive recreational uses*

- Identify any regulatory requirements (e.g. heritage designation, flood plain requirements, etc.)

*The heritage designation is noted above. There are no flood plain or other issues.*

#### 3. Project Objectives

- Outline what is to be achieved by this project

*The intention of the project is to conserve the building by replacing deteriorated, non-original roofing materials; to conserve the existing stone walls by re-pointing and replacement of some minor, likely not original clay brick fragments with stone and by upgrades and replacement of the building mechanical systems to ensure the long-term viability of the building.*

- Provide short term and long term goals and objectives

*The short term objective is to ensure the building’s water-tightness and to ensure proper mechanical functioning. The long term objective is to have this structure remain as part of the fabric of the Riverwood complex and to continue to allow it to be used for active and passive historical interpretation and community uses.*

- Proposed solutions for conservation of the property’s heritage attributes

#### **Conservation recommendations:**

##### **General principles:**

*-the intent of the repair work should be to conserve as much of the historic fabric as possible. Unless the historic fabric is beyond repair the materials will be retained and repaired as necessary and not replaced.*



*-the roof shingles which are proposed to be replaced are from the recollection of City staff<sup>1</sup> understood to be approximately 20 years old, and their appearance bears out this statement. With the exception of deteriorated mortar, no historic fabric is expected to be removed by this intervention.*

**Photo-documentation:**

*-once appropriate scaffolding/ladders are on site the existing roof and walls should be thoroughly photo-documented prior to beginning work*

**Demolition:**

*General – Stone walls: These show evidence of deterioration of mortar, especially at the lower parts of the walls and in areas where water has been allowed to flow along the wall because of poor detailing of eavestroughs and rain water leaders. The deteriorated mortar should be scraped out with hand tools or with a small, portable grinder as required.*



Note Deteriorated and Missing Mortar

*Some instances have been observed where random clay bricks are located in the existing stone walls. These were likely the result of some previous repair. These bricks should be removed completely where possible. Report to consultant if removal is not possible.*

<sup>1</sup> Recollection of Mr. Mark Vanderhelm



Example of Brick Fragment in Existing Stone Wall

General – Asphalt Shingle Roof: The asphalt shingle roof and all associated flashings and trims should be removed completely using hand tools. Inspect the roof sheathing for physical damage or evidence of water intrusion or other deterioration. Photo-document as required. Report findings to consultant.



Note Shingle Deterioration along Lower Edge of Roof, Diagonal Banding on Roof from Curling of Shingles

General – Soffit/fascia/eavestrough/downspouts: These elements appear to be in good condition and are proposed to be maintained but should be inspected once scaffolding or lifting equipment is on-site. Report findings to consultant. Water staining and mortar deterioration in some gable return areas suggest that poor eavestrough detailing is leading to deterioration of the walls. Review findings with consultant once scaffolding is in place. A conservation strategy will be developed at that time.



Example of Wall Deterioration Apparently Caused by Poor Eavestrough Detailing or Condition

General – cleaning: All painted surfaces proposed to be affected should be hand-washed with water and TSP or similar product to remove dirt, grease, etc., before proceeding with the work. Avoid pressure washing.

General – Paint scraping: All areas of loose or peeling paint identified on the architectural drawings to be refinished must be scraped down to solid material. Feather all joints. All areas should be manually scraped first. The use of vibrating sanders is allowed. Belt sanders may be used with caution in particularly difficult applications. Discuss with consultant before using circular sander. Aggressive paint removal techniques including water blasting, sand blasting are not permitted.



Example of Deteriorated Paint Finish on Exterior Door and Frame



General – Caulking: All caulking in areas proposed to be re-finished must be removed by hand-scraping.

General – Interiors and Mechanical Systems: The existing interior finishes have been completely updated and no original heritage fabric is believed to remain in the building. No original mechanical systems remain in the building. Newer finishes and materials may be removed as required and discarded. If original materials or systems are discovered report findings to consultant.

Nails: original square head nails removed during the demolition should be retained. Newer wire nails can be discarded.

Animal intrusion: if invasive animals are discovered during the course of this work a pest control strategy will have to be developed. This is outside the scope of this report.

### **Inspection:**

Paint Surfaces: There may be residue of lead paint on previously painted surfaces. Test samples of paint should be removed and sent to an appropriate facility for testing. Report findings to consultant. In the event that lead paint or other harmful material is discovered a strategy for inspection, containment or removal will be developed at that time.

Asbestos: it is not anticipated that any asbestos or similar deleterious materials will be discovered. In the event that these materials are found to be present a strategy for removal and abatement will be developed at that time.

Note: Professional engineering assessment may be required if unexpected conditions are encountered.

### **Protection during Construction:**

- openings in the building must be temporarily blocked with tightly fitted plywood or other material to prevent water and animal intrusion during the period of construction. All other areas of the building must be similarly protected during the construction process. Remove roof shingles when a period of dry weather can be predicted.

-fire separations and operation of fire alarms, sprinkler systems, etc. must be maintained throughout the construction process

### **Construction:**

Replacement of deteriorated mortar: deteriorated mortar must be replaced completely and tooled to match existing conditions as closely as possible. Use Type O, lime-rich mortar unless directed otherwise by the consultant on-site. Ensure that pointing mortar is softer than the mortar being replaced. Replace voids caused by missing stones or where brick fragments have been dug out with new quarry stones or stones locally gathered to match the existing. Ensure colour and shape of stones will achieve a seamless appearance with the existing wall.



*Brick maintenance and repointing should be undertaken by qualified individuals under the supervision of a heritage consultant and using as a guideline for their work “General Guidelines for the Preservation, Rehabilitation and Restoration of Masonry” from the Standards and Guidelines for the Conservation of Historic Places in Canada and “Practical Conservation Guide for Heritage Properties – Masonry” available from the Region of Waterloo. Both documents are appended to this document.*

*Replacement of wood elements: replacement of wood elements is expected to be limited on this project but removed wood elements must be replaced with like materials to match species and profile as closely as possible. It is to be expected in heritage conservation situations that custom milling of materials may have to take place and that custom cutting knives may have to be made in order to replicate historic profiles. Wood material may have to be purchased “in the rough” and custom milled to required thicknesses. Replaced materials must match removed profiles and sizes exactly.*

*Roofing and flashing: New roofing, underlayment and flashing materials will be installed as specified on the architectural drawings.*

*Painting, sanding and filling: All replaced materials must be coated with one coat of primer on all sides including those not visible. All repaired areas must be filled with appropriate wood filler and putty and sanded to achieve a seamless appearance. Repaired areas must be coated with one coat of primer. Areas where paint is in good condition must be lightly sanded. All affected areas to receive two coats of finish paint in colour and sheen to match existing. Paint must be high quality exterior grade Benjamin-Moore, Sherwin-Williams or similar. Review paint specification with consultant. Show samples of paint match to consultant and City representative for approval. New paint may need to be feathered into the old where an appropriate transition cannot be effected. Allow at least 0.5m of feathering. Assume that paint match may have to be adjusted after first coat application. Provide latex caulking at all transitions between materials or where water may be expected to be encountered. Lap paint finish over caulking.*

*Eavestroughs and Rain Water Leaders: Eavestroughs and rain water leaders on the building are not original, and are intended to be retained per the architectural drawings. As indicated above, a conservation strategy will be developed on site to address issues of poor detailing. If replacement of components is required, all profiles, colour and detailing must match existing. Provide samples to consultant.*

*Nails: nails should be common wire or spiral nails, hot dip galvanized where exposed to the exterior. All nails must be hand driven – no pneumatic or automatic nailing equipment may be used except for the attachment of roof shingles. Nails must be appropriate for their use with a minimum embedment into the substrate of double the thickness of the member being fastened for trim applications.*

#### **Inspection:**

*ARCHITheque and SMDA should be called to inspect at the following project stages at a minimum:*

*-following scaffolding of building but prior to any removals*

- following removal of deteriorated mortar
- following paint scraping and removal of deteriorated wood material
- prior to placing any new material
- after test area of new re-pointing is completed
- after first coat of finish paint is applied
- in the event that unexpected conditions are encountered

#### **Submittals:**

*Contractor will be required to submit to ARCHITheque, SMDA and the City of Mississauga the following:*

- samples of all fasteners, building materials proposed to be used
- data sheets for all re-pointing and painting materials proposed to be used
- samples of all replicated moulding profiles
- samples of eavestrough and rain water leader materials as required

Provide the conservation policies to be used in this project (i.e. what conservation principles will be used to ensure long term conservation, maintenance, monitoring, and sustainable use of the property)

*Generally the existing building is in good condition, appears to have had regular routine maintenance and the work proposed is limited to the replacement of existing deteriorated elements that left unrepaired will allow moisture intrusion into the building and threaten its long term viability. Only deteriorated items will be replaced and serviceable elements will be repaired and retained. The nature of the present and future use, the ownership by the City makes the likelihood of long term maintenance and sustainable use very high.*

#### **4. Statement of Heritage Intent**

- An explanation is required that proposes the reasoning and considerations behind the choice of conservation treatments.

*The conservation treatments proposed are the minimum maintenance requirements to allow the building to continue to function and survive in its present use.*

- Statement as to why one period of restoration over another was selected, rationale for new interventions, background resources used such as principles and conventions of heritage conservation.

*There is no restoration proposed as part of this project and no choice of period. The intention here is periodic maintenance.*

- Statement as to the recording, inventory and disposition/retention of moveable cultural heritage resources (e.g. artifacts, archival material, salvaged material) and its incorporation into the conservation project.

*It is recommended that any materials that are suitable for re-use are stored and conserved. Original square nails should also be stored and conserved.*

## 5. Condition Assessment of the Cultural Heritage Resource(s)

- Condition report of the cultural heritage resource(s) and specific attributes, identifying any deficiencies or concerns.

*The building is generally in good condition. This is discussed above. Inspection did reveal instances of deteriorated wood trims especially around the main floor door on the east side, areas of soffit and fascia that are in need of re-finishing, etc. These are outside the scope of this present project but it is recommended that a strategy be put in place to address these other building deficiencies as soon as possible.*

- Detailed recommendations to mediate and prevent further deterioration. Direction as to use or change in use and how that relates to conserving the heritage attributes.

*The purpose of the intervention on the building is to provide routine maintenance that will prevent further deterioration. It is expected that routine re-inspection will be necessary as is typical with any building whose construction includes significant amounts of stone masonry and painted wood trims, but no more so than any other similar structure.*

- Outline opportunities and constraints with relation to all aspects of the project (i.e. budget, planning issues, public access, long term needs)

*There are no planning issues or other similar considerations.*

- Recommendations for conservation treatments that reference the framework provided in Parks Canada Standards and Guidelines for the Conservation of Historic Places In Canada.

*See Appendix at end of this document.*

## 6. Building System and Legal Considerations

- Statement to explain the building and site use from a practical, logistical and legal perspective

*The building presently functions as an important component of the Riverwood complex. There is public access to the interior of the building and community programming associated with it. City of Mississauga staff use the basement of the building on a daily basis.*

- Input from structural, mechanical, electrical, planning, geotechnical, trades, and all other required fields of expertise to ensure the project is viable and sustainable. Building and site system review may include:

- Site Work (e.g. landscaping, drainage, servicing)

*No site work is proposed and professional engineering services are not expected to be required but they will be called if unexpected conditions are encountered. Structural engineering review will be called if deteriorated structural elements are encountered on inspection.*

- Trees, shrubs, other plantings

*There is expected to be minimal impact on trees and plantings*

- Archaeological concerns and mitigation

*No excavation or disturbance of archaeological resources is proposed*

- Structural elements (e.g. foundation, load bearing)

*Professional engineering review will be called upon in the event that these situation are encountered*

- Building Envelope (roof, wall cladding, window type), Ontario Building Code, Accessibility

*ARCHITheque and SMDA are the architectural and heritage consultants on the project. There are no accessibility issues*

- Mechanical, Plumbing, Electrical

*Mechanical work is confined to the interior with the exception of the addition of one grill on the building exterior. Mechanical work is under the review of the relevant professional engineer.*

- Finishes and Hardware

*New paint finish to match the existing is proposed. Hardware profiles on the eavestroughs and rain water leaders must match the existing if local replacement of components is required.*

- Fire Safety and Suppression

*Maintenance of required fire separations and other life safety considerations are under the review of ARCHITheque.*

- Environmental Considerations, Lighting, Signage and Wayfinding, Security

*No significant environmental considerations are expected. There is no requirement for lighting, signage, wayfinding or security as part of this proposal.*

- Legal Considerations (e.g. easements, encroachments, leasing, etc.)

*The present owners are also the operators of the building. There are no leasing arrangements. There are no known encroachments.*

## 7. Work Plan

- Timeline to describe, in chronological order, to meet the objectives and goals Statement as to specialized trades or skills that will be required to complete the work

The work will consist of:

*-this is summarized above*



*The work will require qualified local trades but nothing particularly specialized. It is not expected that it will be difficult to find trades to execute the work.*

- Proposed budget to meet and sustain the goals and timeline; long term and short term maintenance schedule

*The budget has not been finalized. The City of Mississauga owns a number of heritage buildings and is aware of the cost of maintenance.*

- Monitoring schedule, process and identify those responsible for monitoring

*This is discussed above.*

## 8. Qualifications

- Heritage Conservation Management Plans will only be prepared by accredited, qualified professionals with demonstrated experience in the field of heritage conservation
- Conservation Plans are usually a multidiscipline exercise whereby all consultants on the project must demonstrate accredited professionalism, experience and knowledge in their chosen field of expertise

## 9. Additional Information

- Bibliography of all documentation resources
- List of consultants and other professionals related to the project

*Hitesh Khatri OAA is Architectural Consultant. Rick Mateljan Lic. Tech. OAA CAHP is Heritage Consultant. J. Dasgupta P. Eng. is Mechanical Consultant.*

## 10. Additional Reports that may be required:

- Archaeological report, Arborist's report, Structural engineering report

*Noted above*

- Any other report that City staff may require to assess the project

## 11. Approval Authority

The City of Mississauga will be the approval authority for a Heritage Conservation Management Plan

Contact Information:

Inquiries regarding the submission and requirements of a Heritage Conservation Management Plan should be addressed to Heritage Planning, Culture Division, City of Mississauga

Email: [culture.division@mississauga.ca](mailto:culture.division@mississauga.ca)

## APPENDIX:

Commentary based on Parks Canada Standards and Guidelines for the Conservation of Historic Places In Canada

1. Conserve the heritage value of a historic place. Do not remove, replace or substantially alter its intact or repairable character-defining elements. Do not move a part of a historic place if its current location is a character-defining element.

*Only removal of deteriorated elements is proposed. No movement of any part of the building is proposed.*

2. Conserve changes to a historic place that, over time, have become character- defining elements in their own right.

*No changes to character-defining elements are proposed*

3. Conserve heritage value by adopting an approach calling for minimal intervention.

*The proposed intervention to these buildings is as minimal as possible.*

4. Recognize each historic place as a physical record of its time, place and use. Do not create a false sense of historical development by adding elements from other historic places or other properties, or by combining features of the same property that never coexisted.

*There is no attempt to create a false sense of development.*

5. Find a use for a historic place that requires minimal or no change to its character-defining elements.

*The ongoing use is an excellent and appropriate use of this property.*

6. Protect and, if necessary, stabilize a historic place until any subsequent intervention is undertaken. Protect and preserve archaeological resources in place. Where there is potential for disturbing archaeological resources, take mitigation measures to limit damage and loss of information.

*The building will be protected and stabilized as a result of this intervention.*

7. Evaluate the existing condition of character-defining elements to determine the appropriate intervention needed. Use the gentlest means possible for any intervention. Respect heritage value when undertaking an intervention.

*This is a gentle intervention to this building.*

8. Maintain character-defining elements on an ongoing basis. Repair character- defining elements by reinforcing their materials using recognized conservation methods. Replace in kind any extensively deteriorated or missing parts of character-defining elements, where there are surviving prototypes.

*Noted. This is exactly the purpose of this intervention*

9. Make any intervention needed to preserve character-defining elements physically and visually compatible with the historic place and identifiable on close inspection. Document any intervention for future reference.

*There will be no identifiable change to the building*





## Practical Conservation Guide for Heritage Properties

# Masonry

### Introduction

Masonry - stone, brick, architectural terra cotta, cast stone, concrete and concrete block - is often found on heritage buildings. Common masonry applications include complete masonry exteriors, foundations, chimneys, and decorative elements. Masonry is prone to deteriorate over time. To ensure the visual and structural integrity of your building regular maintenance and cleaning is required.

#### In this guide:

- Understanding Masonry Types
- Maintenance & Repair
- Repointing
  - Physical Examination
  - Mortar Components
  - Undertaking the Work
    - Test Panels
    - Joint Preparation
    - Foundations & Structural Brick
    - Chimneys
- Consultant & Contractor Selection
- Budgeting & Scheduling
- Keep in Mind
- Cleaning
  - Reasons for Cleaning
  - Historic Appearance
  - Choosing the Appropriate Cleaner
  - Cleaning Methods
    - Water Cleaning
    - Chemical Cleaning
    - Poulticing
    - Abrasive & Mechanical Cleaning

This guide provides information on repointing and the variety of cleaning methods and materials that are available for use on the exterior of heritage masonry buildings. The information in this guide was largely adopted from the [US National Park Service Preservation Brief #1](#) and [#2](#) related to repointing and cleaning historic masonry, respectively. Although specifically intended for heritage buildings, the information is applicable to all masonry buildings.

### Understanding Masonry Types

Masonry is a term used to represent a group of building materials that include: stone, brick, architectural terra cotta, cast stone, concrete and concrete block. These materials can represent structural elements of a building or can be used aesthetically as cladding or decorative elements. The occurrence of historic masonry types will often depend on what was locally available from regional quarries. Some types of masonry are more expensive than others or unavailable in certain geographic areas. Expensive or unavailable materials may have been imitated for cost savings. For this reason, along with the similarity in appearance in some masonry, such as sandstone and limestone, it can be hard to differentiate between different masonry types. As well, materials that appear to be masonry, such as decorative cornices, entablatures and window hoods

# Masonry

## Practical Conservation Guide for Heritage Properties

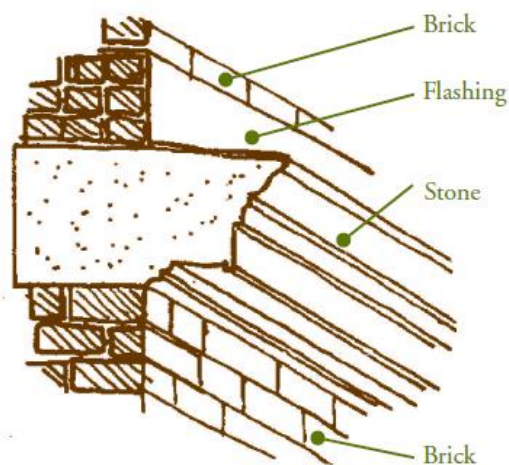


Image: Wall section (Saint John Heritage, 2010)

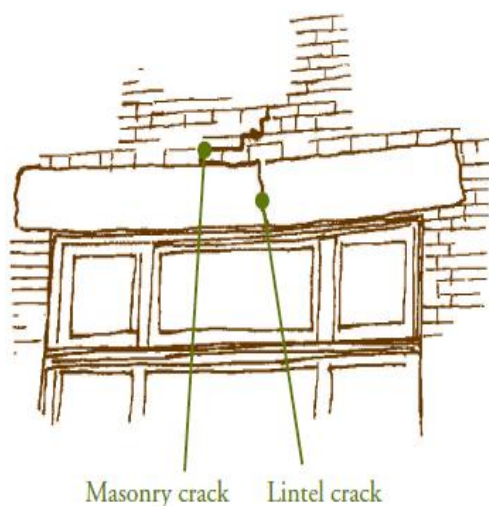


Image: Exterior wall crack (Saint John Heritage, 2010)

may, upon further inspection, prove to be metal and/or wood. The use of stucco, a lime, sand and water mixture, has also commonly been used to imitate masonry. Before beginning any masonry intervention it is important to first properly identify the masonry types you are working with.

### Maintenance and Repair

Investigate and document your masonry surfaces before making alterations or repairs. It is important to identify any deterioration caused by exterior or interior moisture and locate the source. Deterioration, most commonly identified by cracks or spalling, is often a result of:

- Water penetration from the interior or exterior
- Expansion and contraction of materials due to repeated wetting and drying
- Freezing and thawing action of water in the masonry
- Stresses caused by the formation of salt crystals beneath the surface, especially common when cement is used as a quick fix to fill a masonry crack
- Material impurities and incompatibility
- Poor craftsmanship during construction
- Structural settlement shifts

All moisture problems should be resolved before trying to repair the masonry. Repairs often include repointing or cleaning. These should not be attempted by untrained professionals and efforts should be made to ensure that every intervention is reversible.

### Repointing

Re-pointing consists of removing old and damaged mortar from masonry joints and replacing it with new. If the mortar has eroded as deep as the mortar joint is wide, or water is penetrating, then repointing is necessary. Re-pointing is only necessary where mortar has failed. If these issues are not observed over the majority of the brickwork then no intervention is necessary. A building will seldom need to be completely re-pointed. However, if appropriate repairs are not undertaken to halt the source of the problem, mortar deterioration will continue and repointing will have been a waste of time and money. Heritage conservationists recommend that repointing be undertaken by a trained professional.

## Physical Examination

A non-technical evaluation of the masonry units and mortar by an experienced and knowledgeable craftsman can provide information about their strength and permeability. This information is vital when selecting an appropriate repointing mortar. As well, a visual analysis of the historic mortar can provide the clues necessary to choose the new mortar mix and application techniques. The objective in selecting a repointing mortar that is compatible with the masonry units is to mix one that matches the historic mortar as closely as possible. If this is achieved, the new mortar can coexist with the old in a sympathetic and, if necessary, sacrificial way. It is much easier to replace mortar than damaged masonry units.

The strength of a mortar will vary based on its composition. If the mix has a high ratio of Portland cement, a harder mortar will result. The more lime added, the softer, more plastic and workable the mortar becomes. Mortars for repointing projects, especially those involving heritage buildings, are custom mixed, in varying proportions, to ensure they contain the proper physical and visual qualities and can create a mortar with ideal performance and durability. The composition of a particular mortar type should take into consideration all of the factors affecting a specific building, such as: site conditions, current condition of the masonry, function of the new mortar, amount of weather exposure, and skill of the mason.

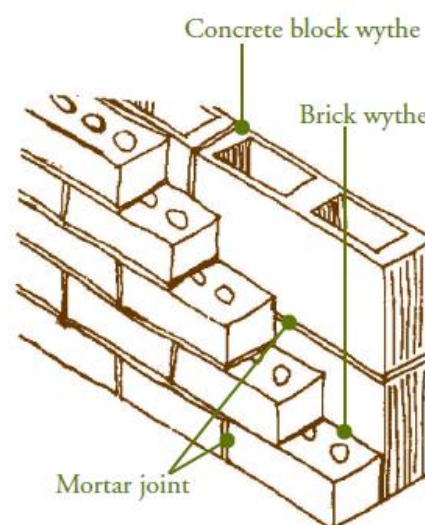


Image: Masonry wall section (Saint John Heritage, 2010)

To prevent damage to the masonry units, **repointing mortars should be softer or more permeable than the masonry units**. It is a common mistake to assume that high strength and hardness is desirable, especially for lime-based historic mortars. Stresses and movements in the walls should be braced by the entire structure, not transferred to individual masonry units through hard mortars. The units' inability to freely move with the structure will result in damage, such as cracks and spalling mortar. Also, the use of mortars with high cement content can trap salt within the masonry envelope, resulting in efflorescence and further deterioration.

New mortar should meet the following criteria:

- Must match the historic mortar in colour, texture and tooling
- Sand must match the sand in the historic mortar (colour and texture of the new mortar will usually be replicated if the sand is well matched)
- Must have greater vapour permeability and be softer (measured in compressive strength) than the masonry units
- Must be as vapour permeable and as soft or softer (measured in compressive strength) than the historic mortar

The mortar application technique and type of mortar joint should be the same as the previously applied mortar and discourage water infiltration.

## Mortar Components

### Sand

Sand is the highest proportion ingredient in mortar and the material that gives it its distinctive color, texture and cohesiveness. Sand must be free of impurities, such as salts or clay.

### Lime

Before the late-19th-century lime was used as the primary binding material in mortar. At that time, limes and other components of mortar varied significantly as they were natural. This is different from modern lime that is manufactured and standardized. Some kinds of lime and other components of mortar that were used historically are no longer readily available, making it difficult to replicate a "historic" mix.

Lime mortar is slightly water soluble and is able to re-seal any hairline cracks that may develop over time. It is a good choice for heritage buildings as it is soft, porous, and changes little in volume during temperature fluctuations. Due to these qualities, high calcium lime mortar could be considered for many repointing projects, not just those involving heritage buildings.

### Portland cement

Portland cement has been commonly used in 20th-century mortar as a primary binding material. A Portland cement and sand mortar is very hard, resists the movement of water, shrinks upon setting, and expands and contracts as the temperature fluctuates. The more Portland cement added to a mortar mix the harder it becomes and the faster the initial set.

## Undertaking the Work

### Test Panels

Test panels are often prepared by the contractor using the same techniques that will be used on the rest of the structure. Several test panels may be necessary to cover all types of masonry, mortar colour and joint styles (see the image on the following page illustrating various brick mortar joints). These are ideally located at inconspicuous locations. The panels can be used as a benchmark to evaluate subsequent work on the building.

### Joint Preparation

To prepare a masonry wall for repointing, the old mortar needs to be removed to a minimum depth of 2-2.5 times the width of the joint. This ensures the new mortar can bond well and will prevent mortar "popouts." The use of hand chisels and mash hammers is the traditional way to remove mortar. These tools are labour-intensive but they are less likely to damage the historic masonry units, while producing a quality result.



# Masonry

## Practical Conservation Guide for Heritage Properties

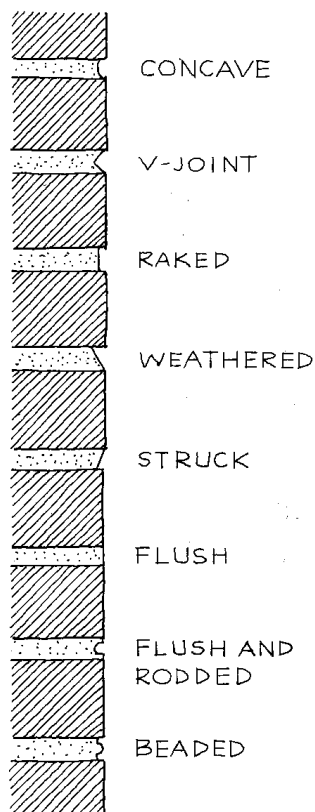


Image: Brick mortar joints  
(Betty Anderson, 1983, p. 101)

However, the use of power saws and grinders is the most common method for mortar removal. The use of these tools by unskilled masons can destroy heritage masonry, especially soft brick. Small pneumatically-powered chisels, however, can generally be used safely and effectively to remove mortar on heritage buildings if a mason uses the equipment appropriately.

### Foundations and Structural Brick

Foundation repairs should be undertaken before permanent work on walls as most cracks in masonry walls, especially those that run horizontally, are based on problems with the foundation. It is also important not to treat structural brick as brick cladding. Care should be taken not to break or disrupt brick tie courses as this may impact the structural integrity of the wall.

### Chimneys

Many heritage buildings have a masonry chimney and their continual exposure to the elements makes them more susceptible to damage and deterioration. To avoid leaks or the danger of fire, chimneys deserve special attention and professional guidance should be sought when considering repairs. Chimney masonry deterioration may include cracks, the breakdown of mortar, or the slanting of a chimney shaft.

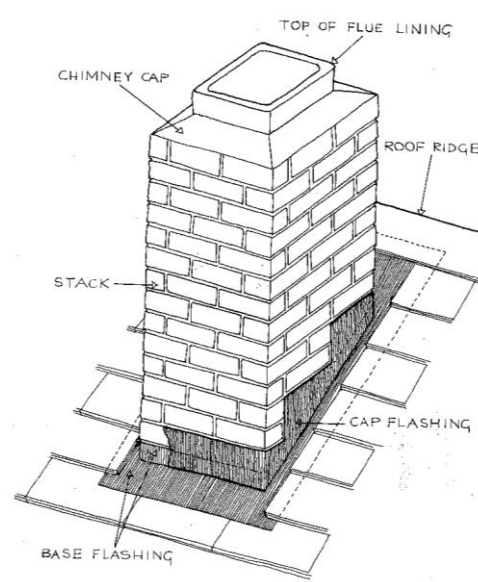


Image: Parts of a masonry chimney (Hanson & Hubby, 1983, p. 70)

### Consultant and Contractor Selection

It may be helpful to retain a consultant, such as a historic architect or masonry expert, to analyze your building for causes of deterioration. They will determine the most appropriate solutions to problems and can prepare specifications that reflect the requirements of each job and can provide oversight of the work as it progresses.

Prior to selection, qualified contractors can also provide lists of other repointing projects you can inspect to assess the quality of their work. Ideally, only choose masons that have a minimum of five years experience repointing heritage masonry buildings.

## Budgeting and Scheduling

Repointing is often expensive and time consuming due to the extent of handwork and special materials required. It is recommended that only the deteriorated mortar be repointed rather than an entire wall. However, if 25-50% or more of a wall needs to be repointed, repairing the entire wall may be more cost effective than spot repointing. Each project requires judgment based on a variety of factors and recognizing this at the outset will help to prevent many projects from becoming prohibitively expensive.

When scheduling repointing, seasonal temperatures are a significant factor to consider as they will affect the amount of time it takes for the mortar to settle and the lime to cure. As a rule, repointing should not be done when the temperature is below 5°C. Work undertaken around 20°C is best to prevent freezing or excessive evaporation of the water in the mortar, which will cause the material to expand or contract and inhibit the proper settling of the masonry units. Ideally, repointing should be done in the shade, away from strong sunlight to slow the drying process, especially during hot weather.

## Keep in Mind

It is important to keep in mind, as the owner of a heritage building, that repointing is likely to be a lengthy, expensive process. The tendency to rush the work or cut corners should be avoided if the heritage building is to retain its structural and visual integrity. To avoid unanticipated problems, schedules for repointing and other associated projects will require planned coordination. Time should be dedicated to evaluating the building's condition and investigating the cause of problems. The work itself is precise, time-consuming and noisy, and scaffolding may temporarily cover portions of the building.

## Cleaning

An important aspect of masonry conservation is choosing the appropriate method for cleaning masonry components. The purpose of this guide is to provide information on the variety of cleaning methods and materials that are available for use on the exterior of heritage masonry buildings, and to provide guidance in selecting the most appropriate method or combination of methods. Masonry cleaning is a perceived improvement but may not always be recommended. Unless these procedures are carried out under the guidance and supervision of a trained professional, they may result in irreparable damage to the heritage structure.

## Reasons for Cleaning

It is important to first determine if cleaning your masonry is necessary. Reasons for cleaning a heritage masonry building include:

- Improving the appearance of the building by removing dirt, soiling materials, or non-historic paint from the masonry
- Preventing deterioration by removing soiling materials that may damage the masonry
- Providing a clean surface to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry

## Historic Appearance

Before removing paint from a masonry building, you should first determine if unpainted masonry is historically appropriate and why the building was painted initially. Structures may have been painted purposefully as a fashionable treatment of the time, to cover bad repointing, unmatched repairs, or to protect soft brick or hide deteriorating stone.

If a building was painted upon its construction or shortly after, the paint should be retained as it may be considered historically important and character defining. Refer to the [Practical Guide: Paint & Colour](#) for more information on paint retention, cleaning and appropriate removal methods.

## Choosing the Appropriate Cleaner

When developing a cleaning program, the construction of your building should be considered. Poorly suited cleaning methods can have a negative effect on the masonry and other building materials. To begin, identify the type of masonry. You should always test the chosen cleaning method on a small inconspicuous surface, as choosing the wrong cleaning agents can permanently damage historic masonry. For example, acidic cleaners can be damaging to acid-sensitive stones, like limestone and marble, and will result in etching and dissolution. A firm understanding of the physical and chemical properties of masonry, coupled with testing, will help avoid accidental damage by cleaning.

It is important to keep in mind that other building materials, such as paint and glass, may be affected by the application of cleaning agents on your structure. Some building elements that may not be visible, such as iron cramps or ties, can suffer corrosion from the use of chemicals, even water. Studying your building's unique construction in detail is the best way to evaluate potential cleaning methods and prevent problems from arising.

## Cleaning Methods

There are four major groups of masonry cleaning methods: water, chemical, poulticing and abrasion. Regardless of the method selected, masonry cleaning projects should begin at the bottom of the structure and work to the top, always keeping all surfaces wet below the area being cleaned. This is advised based on the assumption that dirty water or cleaning solvents dripping from the area being cleaned above will leave streaks on a dirty surface but will not streak a clean surface if it is frequently rinsed.

## Water Cleaning

Water cleaning methods are the gentlest means possible and can be used safely to remove dirt from most types of historic masonry. However, it should be noted that the use of water cleaning on some badly deteriorated masonry, or on gypsum, which is very soluble in water, may be detrimental.

There are four kinds of water-based methods:

### 1. Soaking

Soaking involves prolonged spraying or misting with water and is a useful method for removing heavy accumulations of soot, sulfate or gypsum crusts that usually form on portions of a building protected from the rain. Water washing with gentle scrubbing is frequently used in combination with soaking and is followed by a final water rinse. This is a very slow, gentle method, taking several days or a week.

### 2. Pressure water washing

Pressure water washing is a common method for removing dirt or other soiling from historic masonry. It is recommended to begin by using low-pressure water (100 psi or below), even a garden hose, and then progressing to medium-pressure water as needed (no higher than 300-400 psi). To clean areas of the masonry that are especially dirty, scrubbing with natural bristle or synthetic bristle brushes can help. Avoid the use of metal brushes. They can erode the masonry surface and/or imbed metal particles that may stain the masonry.

### 3. Water washing with detergents

The use of non-ionic detergents, which are synthetic organic compounds and different from household soaps, are used effectively to remove oily soil, especially when added to a low or medium-pressure water wash. Unlike household detergents, non-ionic detergent does not leave a visible residue on masonry. Cleaning textured or intricately carved masonry can be achieved by scrubbing non-ionic detergent with a natural or synthetic bristle brush. Scrubbing should be followed with a final water rinse.

### 4. Steam cleaning

Steam cleaning is equivalent to a low-pressure hot water washing as the steam condenses upon leaving the hose. It is a gentle method ideal for:

- Cleaning stone, especially acid-sensitive stones
- Removing built-up soil deposits and dried plant materials
- Cleaning carved stone details

Steam cleaning does not generate a lot of water runoff and may also be appropriate for cleaning interior masonry. Paint and graffiti can be removed using the DOFF system, a steam based stone cleaning apparatus that uses super heated steam. Before removing graffiti, refer to the Region of Waterloo's [Practical Guide: Paint & Colour](#) for further information.



### Potential hazards of water cleaning

Although water-based methods are the gentlest method for cleaning your historic masonry, they still present an opportunity for damage if not well thought out.

It is important to keep in mind that "power washing" at too high a pressure is very abrasive and can easily wear away brick and other soft stones, like marble. As well, the type of nozzle used and the distance it is placed from the masonry surface, coupled with the gallons per minute (gpm), are important variables to consider when water cleaning. Visible grains of stone or sand in the water or solvent runoff is a good indication that the water pressure is too high. Without careful consideration of these factors damage may be done to the heritage masonry. For this reason it is important to take time to work through the process carefully and monitor the results.

To avoid the spalling and cracking of masonry units, do not use cleaning methods that involve water if there is the threat of frost. Moisture trapped in masonry will cause the unit to expand and become damaged. After cleaning, a masonry wall may take over a week to dry. Therefore, water cleaning should not be permitted for several days prior to the first forecasted frost date.

### Chemical Cleaning

Chemical cleaners work on historic masonry by reacting with dirt, soiling material or paint, including graffiti. After the reaction, the runoff is rinsed from the masonry surface with water. Chemical cleaners used to remove dirt and stains include acids, alkalis and organic compounds. Paint removers are alkaline, based on organic solvents or other chemicals (please see [Practical Guide: Paint & Colour](#) for information on paint removal).

There are two types of chemical cleaners used to remove dirt:

- 1. Acidic Cleaners**

Acid-based cleaning products should only be used on non-acid-sensitive masonry, including: granite, most sandstone, slate, unglazed brick, unglazed architectural terra cotta, cast stone and concrete. Hydrofluoric acid is the main ingredient in most commercial acidic cleaners. The process involves applying acid cleaners to the pre-wet masonry that should then be kept wet while the acid is cleaning. When the process is complete the acid should be removed with a water wash.

- 2. Alkaline Cleaners**

Alkaline cleaners should only be used on acid-sensitive masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, and polished granite. Two ingredients primarily compose alkaline cleaning products: a non-ionic detergent or surfactant, and an alkali such as potassium hydroxide or ammonium hydroxide.

The treatment process is similar to that of acidic cleaners, with the addition of two steps. The alkaline cleaner is applied to pre-wet masonry, allowed to settle and then rinsed off with water. Next, the masonry is neutralized with a slightly acidic wash, often with acetic acid, and then rinsed with water again. Alkaline cleaners may need to set longer than acidic cleaners.

Removing stains effectively depends on matching the right remover to the stain. Stains may be: industrial (smoke, soot, grease, tar), metallic (iron, copper), or biological (plant, fungal). The successful removal of stains from historic masonry may require a process of elimination until the right remover is found.

Stripping layers of paint from historic masonry is done by applying the remover with a brush, roller or spray, followed by a water wash. There are three types of chemical cleaners used to remove stains, paint and graffiti:

**1. Alkaline paint removers**

Alkaline paint removers are often similar in composition to alkaline cleaners. They can effectively remove multiple layers of paint, specifically oil, latex and acrylic paints, and may also remove some acrylic water-repellent coatings. Similar to other alkaline cleaners, an acidic neutralizing wash and final water rinse are recommended following their use.

**2. Organic solvent paint removers**

Organic solvent paint removers may include a combination of solvents, including methylene chloride, methanol, acetone, xylene and toluene.

**3. Other paint removers and cleaners**

Paint removers based on N-methyl-2-pyrrolidone (NMP), or on petroleum-based compounds can also be used to remove paint and some graffiti from heritage masonry.

**Potential hazards of chemical cleaning**

As most chemical cleaning methods involve water, they are susceptible to the same hazards as mentioned in the water cleaning section above. As well, many chemical cleaners do not work in cold temperatures, so their use should be avoided in months with the potential for frost. It is important to keep in mind that acidic and alkaline cleaners can be dangerous to those using them. Precautions should be taken to limit environmental contamination and plan for the safe disposal of chemicals associated with masonry cleaning.

Chemical cleaners have the potential to react adversely with many types of masonry if not chosen appropriately. Unfortunately, the composition of masonry materials is not always known and for this reason testing the cleaner on an inconspicuous spot on the building's masonry is advisable.

## Poulticing

The use of a poultice is often the most effective way to remove graffiti and stains that have penetrated masonry. A poultice is a paste that can be applied to a stain. It is composed of an absorbent material or clay powder (such as kaolin or fuller's earth, or even shredded paper or paper towels), mixed with a liquid (a solvent or other remover). The moist poultice should remain on the stain as long as it takes to dry and draw the stain out of the masonry surface. The masonry must be thoroughly rinsed once the stain has been removed.

## Abrasive and Mechanical Cleaning

As a general rule, the use of abrasive cleaning methods is not recommended on heritage buildings as they operate by wearing down dirt or paint from a masonry surface. These methods include grit blasters, grinders and sanding discs, all of which mechanically remove dirt, soiling material or paint, and possibly some of the masonry surface. Blasting with abrasive grit or another rough material is the most commonly used abrasive technique. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces are most at risk of physical and aesthetic damage by abrasive methods. Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning, leading to water penetration and ultimately to the need to repoint.

## Summary

Well-planned masonry repointing and cleaning efforts are essential to the preservation, restoration or rehabilitation of historic masonry. Adhering to the guidelines discussed in this practical guide can enhance the aesthetics and structural stability of a masonry heritage building. A sound repointing job can last at least 30 years and as long as 100 years; guaranteeing the long life of the mortar joint, the wall, and ultimately the historic structure. As such, the mortar joint in a heritage masonry building has been called a wall's "first line of defense." It is important to remember that mortar joints are intended to be sacrificial and will probably require repointing in the future.

If undertaken by qualified individuals, removing years of accumulated dirt, pollutants, stains, graffiti and paint can extend the life of a heritage structure. Cleaning masonry should be done using the gentlest means possible to avoid damage. Using the wrong cleaning method or using the right method incorrectly can result in serious damage, both physically and aesthetically. You should always pause before undertaking work to evaluate and determine if the intervention is really necessary and in the best interest of the overall structure. Do not hesitate to seek guidance from masonry experts before undertaking any work to your heritage structure.

## References

If you would like to learn more about conserving your historic masonry, please refer to the following primary sources:

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Stonehealth Ltd. "Stonehealth DOFF system." [www.stonehealth.com/stone-cleaning-products/doff-system/](http://www.stonehealth.com/stone-cleaning-products/doff-system/)

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#### **Disclaimer**

This practical guide contains useful information on restoring and preserving heritage buildings, but it is intended as a general resource only. Content from third parties with specific expertise has been heavily relied upon and their original works have been acknowledged in the list of references included at the end of this document. The Region of Waterloo has taken all reasonable steps to ensure the accuracy of the information in this publication. However, it is recommended that building owners consult with trained specialists, such as contractors, builders, plumbers, heating and air professionals and electricians, before undertaking any renovations, repairs or construction on their properties. The Region does not assume responsibility for any loss or damage resulting from adherence to the information in this practical guide.



## GENERAL GUIDELINES FOR PRESERVATION, REHABILITATION AND RESTORATION

	Recommended	Not Recommended
1	<b>Understanding</b> the properties and characteristics of the masonry of the historic place.	
2	<b>Documenting</b> the form, materials and condition of masonry before undertaking an intervention. For example, identifying the particular characteristics and source of the type of stone or brick used, and the composition of the mortar.	Undertaking an intervention that affects masonry without first documenting its existing character and condition.
3	<b>Protecting</b> and maintaining masonry by preventing water penetration, and maintaining proper drainage so that water or organic matter does not stand on flat surfaces, or accumulate in decorative features.	Failing to identify, evaluate and treat the causes of masonry deterioration.  Applying water-repellent coatings to stop moisture penetration when the problem could be solved by repairing failed flashings, deteriorated mortar joints, or other mechanical defects.
4	<b>Applying</b> appropriate surface treatments, such as breathable coatings, to masonry elements as a last resort, only if masonry repairs, alternative design solutions or flashings have failed to stop water penetration, and if a maintenance program is established for the coating.	
5	<b>Sealing</b> or coating areas of <i>spalled</i> or blistered glaze on terra cotta units, using appropriate paints or sealants that are physically and visually compatible with the masonry units.	
6	<b>Cleaning</b> masonry, only when necessary, to remove heavy soiling or graffiti. The cleaning method should be as gentle as possible to obtain satisfactory results.	Over-cleaning masonry surfaces to create a new appearance, thus introducing chemicals or moisture into the materials.  Blasting brick or stone surfaces, using dry or wet grit sand or other abrasives that permanently erode the surface of the material and accelerate deterioration.  Using a cleaning method that involves water or liquid chemical solutions when there is a possibility of freezing temperatures.  Cleaning with chemical products that damage masonry or mortar, such as using acid on limestone or marble.  Failing to rinse off and neutralize appropriate chemicals on masonry surfaces after cleaning.  Applying high-pressure water cleaning methods that damage the masonry and mortar joints and adjacent materials.

## GENERAL GUIDELINES FOR PRESERVATION, REHABILITATION AND RESTORATION

	Recommended	Not Recommended
7	<b>Carrying out</b> masonry cleaning tests after it has been determined that a specific cleaning method is appropriate.	Cleaning masonry surfaces without sufficient time to determine long-term effectiveness and impacts.
8	<b>Inspecting</b> painted masonry surfaces to determine whether paint can successfully be removed without damaging the masonry, or if repainting is necessary. Testing in an inconspicuous area may be required.	
9	<b>Removing</b> damaged or deteriorated paint only to the next sound layer, using the gentlest method possible; for example, hand scraping before repainting.	Removing paint that is firmly adhering to masonry surfaces.  Using methods of removing paint that are destructive to masonry, such as sandblasting, application of caustic solutions, or high-pressure water blasting.
10	<b>Re-applying</b> compatible paint or coatings, if necessary, that are physically compatible with the previous surface treatments and visually compatible with the surface to which they are applied.	Applying paint, coatings or stucco to masonry that has been historically unpainted or uncoated.  Removing paint from historically painted masonry, unless it is damaging the underlying masonry.  Removing stucco from masonry that was historically never exposed.
11	<b>Retaining</b> sound and repairable masonry that contributes to the heritage value of the historic place.	Replacing or rebuilding masonry that can be repaired.
12	<b>Stabilizing</b> deteriorated masonry by structural reinforcement and weather protection, or correcting unsafe conditions, as required, until repair work is undertaken.	
13	<b>Repairing</b> masonry by repointing the mortar joints where there is evidence of deterioration, such as disintegrating or cracked mortar, loose bricks, or damp walls.	Removing sound mortar.
14	<b>Removing</b> deteriorated or inappropriate mortar by carefully raking the joints, using hand tools or appropriate mechanical means to avoid damaging the masonry.	Using rotary grinders or electric saws to fully remove mortar from joints before repointing. In some instances it may be acceptable to make a single pass with a cutting disk to release tension in the mortar before raking the joint. Extreme caution must be used to prevent accidental damage.

## GENERAL GUIDELINES FOR PRESERVATION, REHABILITATION AND RESTORATION

	Recommended	Not Recommended
15	<b>Using</b> mortars that ensure the long-term preservation of the masonry assembly, and are compatible in strength, porosity, absorption and vapour permeability with the existing masonry units. Pointing mortars should be weaker than the masonry units; bedding mortars should meet structural requirements; and the joint profile should be visually compatible with the masonry in colour, texture and width.	Repointing with mortar of a higher Portland cement content than in the original mortar. This can create a bond stronger than the historic material (brick or stone) and cause damage as a result of the differing expansion coefficients and porosity of the materials.  Repointing with a synthetic caulking compound.  Using a 'scrub' coating technique to repoint instead of using traditional repointing methods.
16	<b>Duplicating</b> original mortar joints in colour, texture, width and joint profile.	
17	<b>Replacing</b> in kind extensively deteriorated or missing parts of masonry elements, based on documentary and physical evidence	Using a substitute material for the replacement part that neither conveys the same appearance as the masonry element, nor is physically or chemically compatible.

## ADDITIONAL GUIDELINES FOR REHABILITATION PROJECTS

	Recommended	Not Recommended
18	<b>Repairing</b> masonry by patching, piecing-in or consolidating, using recognized conservation methods. Repair might include the limited replacement in kind, or replacement with a compatible substitute material, of extensively deteriorated or missing masonry units, where there are surviving prototypes. Repairs might also include dismantling and rebuilding a masonry wall or structure, if an evaluation of its overall condition determines that more than limited repair or replacement in kind is required.	
19	<b>Replacing</b> in kind an irreparable masonry element, based on documentary and physical evidence.	Removing an irreparable masonry element and not replacing it, or replacing it with an inappropriate new element.

### HEALTH, SAFETY AND SECURITY CONSIDERATIONS

20	<b>Removing</b> hazardous materials from masonry, using the least-invasive abatement methods, and only after adequate testing has been conducted.	
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### SUSTAINABILITY CONSIDERATIONS

21	<b>Selecting</b> replacement materials from sustainable sources, where possible. For example, replacing deteriorated stone units using in-kind stone recovered from a building demolition.	
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## ADDITIONAL GUIDELINES FOR RESTORATION PROJECTS

	Recommended	Not Recommended
22	<b>Repairing</b> , stabilizing and securing masonry elements from the restoration period, using recognized conservation methods. Repairs should be physically and visually compatible and identifiable on close inspection for future research.	<p>Removing masonry elements from the restoration period that could be stabilized and conserved.</p> <p>Replacing an entire masonry element from the restoration period, when repair and limited replacement of deteriorated or missing parts is possible.</p> <p>Using a substitute material for the replacement that neither conveys the same appearance as the surviving masonry, nor is physically or chemically compatible.</p>
23	<b>Replacing</b> in kind a masonry element from the restoration period that is too deteriorated to repair, based on documentary and physical evidence. The new work should be well documented and unobtrusively dated to guide future research and treatment.	Removing an irreparable masonry element from the restoration and not replacing it, or replacing it with an inappropriate new element.