

Flood Resilient Materials

Prepared by: Credit Valley Conservation

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1. Interior Options

Homeowners have many options for altering their walls, floors, and home interior to introduce flood resilience into living spaces.

1.1. Flood Resilient Structural Materials

Careful selection of structural members and materials can introduce resilience to flood-prone areas in the home. Below are suggestions for materials that can be expected to survive flood events.

Concrete (pre-cast or in-place): When free of cracks, concrete floors protect against water seeping into houses from below, and concrete is a principal material in exterior foundation walls. Concrete also dries with relative ease. Note, however, that concrete can become unacceptable for habitation if it is exposed to petroleum-based contaminants (e.g. heating oil) during floods.

Joists, studs, trusses, and headers: Flood conditions can lead to structural wall components warping, expanding, or decaying. There are many material choices that can be made to resist the deformation and damage of members during flood conditions.

Decay-resistant wood: Some species of wood are better suited for flood-prone areas due to their intrinsic resistance to decay. This can be a consequence of chemical compounds (extractives) or other properties. Redwood, cedar, and black locust are some examples of decay-resistant wood.

Preservative-treated solid wood: Solid woods that have been pressure-treated with borate, alkaline copper quaternary (ACQ), or copper azole (CA) are treated to protect against decay from fungi and insects. The intent of this treatment is not to explicitly provide flood resilience, but the treatment can protect wooden structural members from fungal growth after flooding.

Metal: Aluminum and steel building frames are do not experience the same deterioration as wooden frames and are more likely to resist flood damage.

Reinforced frames: Reinforcing or bracing hardwood frames can also help protect against warping. Note that acidic timbers may contribute to the corrosion of metal reinforcing materials.

Flood resilient plywood: Interior-rated plywood is not water-proof and is, therefore, susceptible to decay after flood exposure. Marine-grade and preservative-treated plywood alternatives, however, have flood-resilient properties.

Marine-grade plywood: Marine-grade plywood consists of multiple layers of hardwood bound together by a water-proof glue. It is suitable for exterior use

or applications where exposure to water is expected. Exposure 1 or exterior-grade plywood is also acceptable.

Preservative-treated plywood: Like preservative-treated solid wood, plywood can also be pressure-treated with preservatives to provide decay resistance.

1.2. Wall Construction

Conventional wall construction materials are often not flood recoverable because they become warped, saturated, and structurally unsound after enduring flood conditions. There are, however, many options for flood resilient wall construction that residents can implement. Here are some recommendations for resilient interior wall construction:

Lime-containing plaster and mortar: Typical cement-based plasters and mortars can become saturated by contact with water, trapping moisture and leading to rot where it is in contact with wood. Lime-containing plasters and mortars can provide an alternative that dries more easily and is less likely to need replacement. Lime's alkalinity also provides antibacterial properties.

Water-proof paint: Polyester-epoxy, latex, and oil-based paints can be applied directly to concrete structural walls. These same paints, however, are not appropriate for application to wood because water-proofing wood surfaces can inhibit drying.

Flood-resilient panelling: Walls can be made flood resilient by carefully selecting panels or materials that dry effectively after flooding. Where appropriate, water-proof adhesives should be used for installation.

Removeable timber panelling: Removeable wall panels can allow materials that are behind them to dry quickly after flooding.

Cement board: Although they are not water-proof, cement boards are water resistant and can withstand short-duration flood conditions without needing replacement. Note that cement board should be installed with one face exposed such that evaporation can occur.

Non-paper gypsum board: Like cement board, gypsum board is water resistant and can withstand short-duration flood conditions without needing replacement. Gypsum board should exclude paper to resist the growth of mold. Like cement board, gypsum board should be installed with one face exposed such that evaporation can occur.

Blue board: Also known as plaster baseboard, blue board drywall is mold and water resistant, and it is often used in bathrooms where contact with water is expected.

Aluminum and steel wall panels: Aluminum and steel have corrosion-resistance that make them acceptable materials for flood resilient wall panelling. Various treatments are available for improved resistance.

PVC wall panels: PVC offers the same resistance to decay as metal alternatives.

Clay tiles (structural glazed): Clay tiles, or glazed blocks, have a ceramic glaze and can be used to construct water-proof loadbearing or non-loadbearing walls.

Glass blocks: Glass tiles and blocks can be selected as a water-proof material for walls and windows.

Flood resilient doors: Aside from wall materials, interior doors that are constructed to be flood resilient can be selected.

Metal Door: Metal doors with hollow, wood, or foam-filled cores provide acceptable flood-resilience.

Fibreglass Door: Fibreglass doors with wood cores also provide acceptable flood resilience.

Rubber baseboard: Rubber is a water-proof alternative to wood and MDF baseboards.

1.3. Floor Construction

Like walls, conventional flooring materials are often unsalvageable after flood events. There are many construction strategies that can resist flood damage. These are some recommendations for resilient floor construction:

Water-proof membrane: A water-proof membrane should be installed between concrete structural decks and all wood or tile flooring.

Tile flooring: Rubber mats and tiles are, themselves, flood resilient, but installing them on concrete floors can result in trapped moisture and the growth of harmful pathogens. It is recommended that ceramic, porcelain, vinyl, or concrete tile be installed with a sealant. Furthermore, mortar must be used for installation, instead of organic adhesives, except in the case of vinyl tiles. Note that vinyl is only acceptable for installation when adhered with a chemical-set adhesive. Furthermore, vinyl tiles should only be installed on concrete structural floors, since applications on plywood present issues with drying.

Tile sealant/resin: The need for sealant will depend on the type of flooring being installed. As some examples, ceramic and porcelain tiles can be sealed with surface-

penetrating sealers, and many water-proofing products exist for concrete and masonry.

Water-proof grout: Epoxy or other water-proof grouts can protect moisture from penetrating the floor between and beneath tiles.

Recycled plastic lumber: Plastic flooring options are not susceptible to decay from water damage and fungal growth that wood flooring options experience during and after flood events.

Braced flooring: Wood floor panels can expand and warp during exposure to floodwater. To avoid this deformation, consider using braced floor panels.

Expansion joints: Providing small gaps between adjacent floorboards can allow for panels to expand without buckling.

Terrazzo flooring: Although it is a more expensive option, Terrazzo floors are durable and water-proof.

Flood-proof screeds: A variety of screeds can provide additional water resilience. Some examples include cement, epoxy, latex, and polyurethane.

1.4. Closed-Cell Insulation

Fibrous and open-cell insulation types become easily saturated during flood events. Closed-cell insulation batts, sprays, and injections are not easily saturated by water and can be much more easily cleaned after flooding.

1.5. Fasteners

The success of flood resilient materials at protecting homes from flood damage is in-part dependent on the performance of the anchors, nails, screws, and bolts that fasten materials in-place. Consider how wood treatments could corrode fasteners and connectors. According to the US Federal Emergency Management Agency (FEMA), fasteners made of stainless steel, hot-dipped zinc coated galvanized steel, silicon bronze, or copper are recommended where preservative-treated wood is installed.

1.6. Raised Utility Hardware

To avoid flood damage and short-circuiting, electrical outlets and associated wiring can be raised one (1) foot above the expected 100-year flood elevation. Furthermore, appliances and other hardware (electrical panels, stoves, refrigerators, furnaces, water heaters) may be raised above the expected 100-year flood elevation to provide protection from flood damages. This can be achieved by relocating units to a higher floor or providing flood-proof platforms (e.g. stainless steel or brick).

1.7. Moisture Alarms

It is advantageous to have a moisture alarm in the lower levels of a home so that residents can be alerted when flooding occurs. These alarms will make noise when they are in contact with water, and there are models that can send alerts to the user's phone or even to an alarm company. Alarms that can alert homeowners while they are absent from the property are beneficial because they can ensure that the user does not lose insurance coverage due to inadequate monitoring of the property. Their use can also help lower home insurance premiums.

1.8. Flood Barriers

Doors and windows cannot be expected to stop floodwater from entering a home unless they are specifically designed to do so. To prevent water from entering through doors and windows, flood barriers can be temporarily installed. These barriers can seal windows or doorways up to a certain height, preventing water from entering the building. Doors and gates that are custom fitted to keep floodwater out of houses and properties are also available. Furthermore, flood barriers are available for interior doors, garage doors, and gates for properties that have masonry walls along their perimeters.

2. Exterior Options

Ideally, flooding is prevented or minimized with measures that are external to homes. There are a series of modifications that homeowners can make to their properties and foundation walls to lessen the risk of home flooding.

2.1 Topsoil and Grading

Property grading adjacent to houses can play an important role in protecting homes from overland flooding. Topsoil can be applied around buildings to facilitate drainage away from the foundation wall. Grading should be performed such that a 5% grade away from the building is achieved after settling has ceased. Backfill should be capped with a low-permeability soil or a membrane that can support drainage and prevent infiltration along the foundation wall. If backfill is capped with low-permeability soil, good quality control of the soil must be in-place, and the foundation exterior wall must be sufficiently water-proofed.

2.2 Silicone Sealant for Eavestroughs and Downspouts

Eavestroughs and downspouts that are damaged can leak and fail to direct rainwater away from the foundation wall of buildings. Using silicone sealant to repair breaks can ensure that drainage is conveyed away from houses.

2.3 Damp-Proofing Foundation Membrane

Cracks and breakages in foundation walls can be a route for groundwater or runoff to seep into buildings. Applying damp-proofing membranes can prevent water from contacting the foundation, lowering the risk of water damage to the building exterior or seepage into the building interior.

2.4 Damp-Proofing Foundation Coating

Like damp-proofing membranes, damp-proofing coatings can be applied to exterior foundation walls to prevent water from contacting the building, preventing infiltration into basements through cracks and breakages.

2.5 Foundation Repair

Sealing cracks in foundation walls and basement floors can prevent water from infiltrating into the house. Cracks can be sealed from the interior or exterior of the house, and different methods may be more appropriate depending on the extent of the cracking. Materials such as asphaltic hardening liquid, hydraulic cement, urethane injections, or silicone sealants can be used.

2.6 Corrugated Steel Window Wells and Covers

Corrugated steel window wells that fit tightly against the foundation wall can prevent below-grade drainage from seeping into the window well. These barriers require effective drainage away from the foundation wall to be beneficial, and the inclusion of window well covers can further prevent accumulation of rainwater in window wells. Window wells and covers must not inhibit egress from windows that serve as fire escape routes for residents.

2.7 Self-Closing Air Bricks

Air bricks, or air vents, are important components of external walls that allow air to circulate within the home, relieving the accumulation of moisture and providing temperature regulation. Unfortunately, the use of conventional air bricks provides a route for flood water to enter the building. Self-sealing air bricks are an alternative that passively stop floodwater from entering the home while also allowing the circulation that is desired under normal conditions.

2.8 Extended Well Casing

Floodwater that spills into well casings can lead to long-term contamination of on-site water sources. This can be prevented by extending the height of well casings at least two (2) feet above the expected 100-year flood elevation such that flood water cannot overtop the well opening.

2.9 Veneers and Flood Skirts

Brick veneers that are backed by a water-proof membrane can be constructed along the perimeters of homes to protect against damage and seepage into the building interior. Impermeable skirts can also be installed along building perimeters to protect houses from direct contact with surface flooding. Consider supplying a seepage pump on the opposite side of skirts to remove any flood water that passes the barrier.

2.10 Gypsum Exterior Sheathing

Gypsum exterior sheathing is a water-resistant material that can be attached to exterior walls as an underlay for siding materials.

2.11 Brick Selection

When installing brickwork, consider selecting a brick that provides improved flood protection. Some examples of flood resilient bricks are glazed bricks, clay bricks, cast stone, and concrete blocks. The use of a lime-based mortar is also recommended.

2.12 Weeping Tile (Foundation Drain) Repair

Weeping tile systems help to collect water which has percolated below ground to the base of your foundation. These systems carry water away from your home to limit hydrostatic pressure and the potential for pooling and infiltrating water. Weeping tile systems typically consist of continuous plastic perforated pipes, which are wrapped in a geotextile filter fabric that prevents soils, including clay and silt material, from entering the system. Granular gravel fill should be added around the perforated pipes to facilitate the flow of water into the system, before adding backfill. Where possible, the implementation of a cleanout or inspection port is recommended to facilitate regular inspections and maintenance of the weeping tile system.

A recommended best practice is to disconnect weeping tile systems from the City's sewer network by severing and capping the underground sewer connection to limit the potential for sewer overflows or backups into the home. Water collected from the weeping tile system can instead be directed into a sump pit, with a sump pump that moves the water away from the building foundation. The City of Mississauga offers a rebate for weeping tile capping under the [Basement Flooding Prevention Rebate Program](#).

3. List of Eligible Materials

The list below specifies the materials that are eligible for reimbursement under the Flood Resilience Rebate Program. Note that the cost of materials and labour for installation are eligible for reimbursement.

Interior - Structural Concrete (pre-cast) Concrete (formed in-place) Decay-resistant wood Preservative-treated solid wood (borate) Preservative-treated solid wood (ACQ) Preservative-treated solid wood (CA) Aluminum building frames Steel building frames Plywood (marine-grade) Plywood (exterior-grade) Plywood (exposure 1) Preservative-treated plywood (ACQ) Preservative-treated plywood (CA) Interior - Wall Lime-containing plaster Water-proof paint Removeable timber panelling Cement board Non-paper gypsum board Blue board Aluminum panels Steel panels PVC wall panels Clay tiles (structural-glazed) Glass blocks Glass tiles Metal doors (hollow) Metal doors (wood core) Metal doors (foam-filled core) Fibreglass door (wood core) Rubber baseboard Interior - Floor Water-proof membranes Ceramic tile Porcelain tile Vinyl tile Concrete tile Mortar Tile sealant	Interior – Floor (Cont.) Water-proof grout (epoxy) Recycled plastic lumber (not wood-filled) Pressure-treated wooden floor panels Flooring braces Terrazzo flooring Cement screeds Epoxy screeds Latex screeds Polyurethane screeds Interior - Other Closed-cell insulation sprays Closed-cell insulation batts Closed-cell insulation injections Materials/labour for raising utility hardware Materials/labour for raising appliances Moisture alarms Flood barriers (for doors and windows) Exterior Topsoil Low-permeability soils Silicone sealant Damp-proof foundation membranes Damp-proof foundation coatings Hydraulic cement Asphaltic hardening liquid Urethane injections Corrugated steel window wells Window well covers Self-closing air bricks Well casings Gypsum exterior sheathing Glazed bricks Clay bricks Cast stone Concrete blocks Weeping tiles - plastic perforated pipe Weeping tiles - geotextile filter cloth Weeping tiles - granular gravel fill
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4. Disclaimer

The information contained in this catalogue is intended to inform residents of options available for incorporating flood resilience into residential properties. Credit Valley Conservation and the City of Mississauga assume no responsibility for damages or losses that occur because of the installation of the materials eligible through the Flood Resilience Rebate Program.

5. References

When reviewing this catalogue, also refer to Credit Valley Conservation's *Technical Guidelines for Floodproofing*.

Key references:

- [Credit Valley Conservation. *Technical Guidelines for Floodproofing*.](#)
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