Institute for Catastrophic Loss Reduction
Building resilient communities

Institut de Prévention des Sinistres Catastrophiques
Bâtir des communautés résilientes

ICLR/CHBA Resilient Homes Task Force

Good, Better, Best Resilience Options

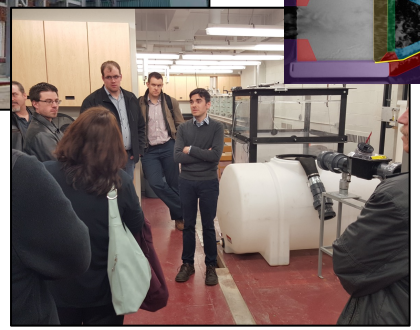
Dan Sandink, Director of Research – dsandink@iclr.org

IBWG – June 25, 2025

Institute for Catastrophic Loss Reduction

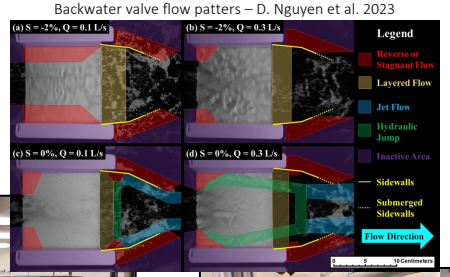
Western | Institute for Catastrophic Loss Reduction (ICLR)

Understanding vulnerability, risk reduction options

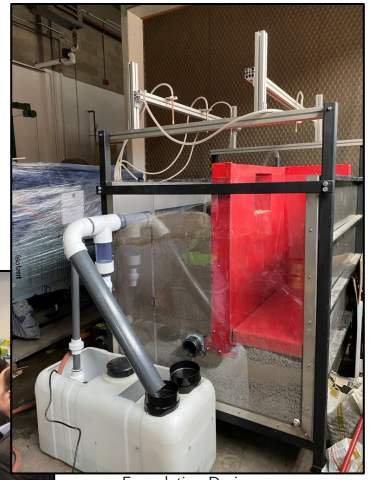


Boundary Layer Wind Tunnel, Three Little Pigs, damage inspection – UWO; Fastener withdrawal tests – K. Porter

Backwater valve flow patters – D. Nguyen et al. 2023



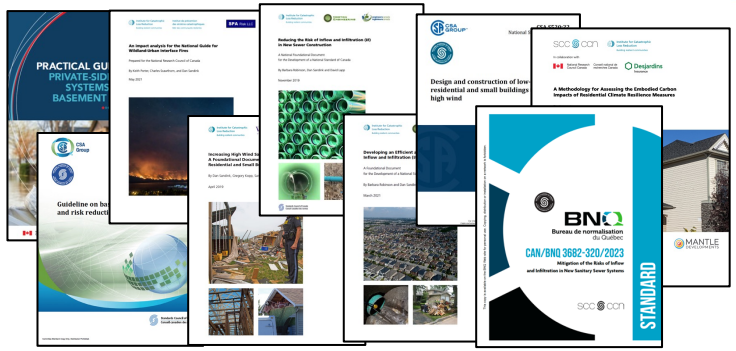
ICLR/U of G Basement Flood Protection Lab: https://basementfloodlab.com/



Foundation Drainage Model, U of G/ICLR

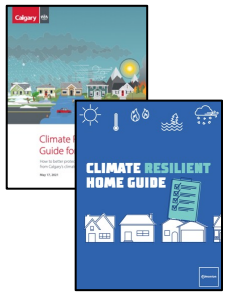
WUI fire inspections

Standards, guides, assessment methods



PIEVC CVIIP

www.pievc.ca



Basement flood protection; BCAs, foundational documents, I/I standards

Supporting implementation, pilots

Resilient Homes Task Force

Insurers Rebuild Stronger Homes

Basement Flood Protection Demonstration Event

A special event in Edmonton, Alberta

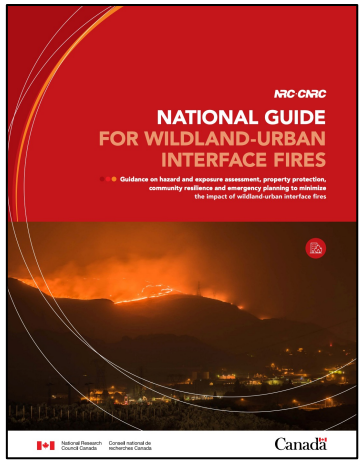
Institute for Catastrophic Loss Reduction
Building resilient communities

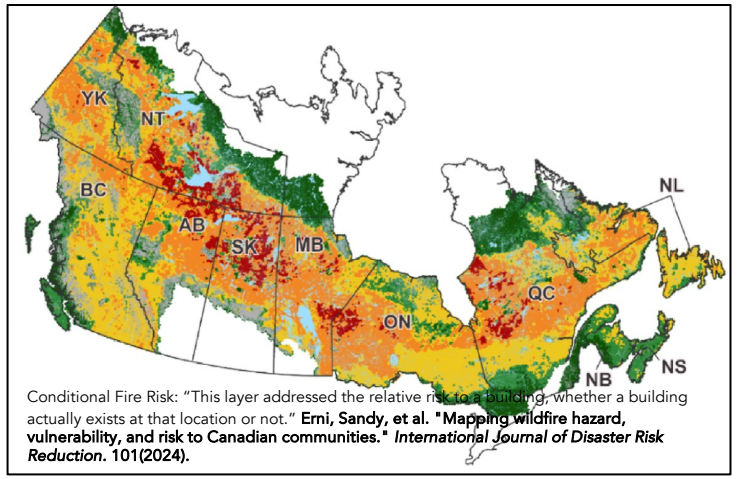
TD Insurance

Why tiered resilience options?

The knowledge largely exists – but how to mobilize?

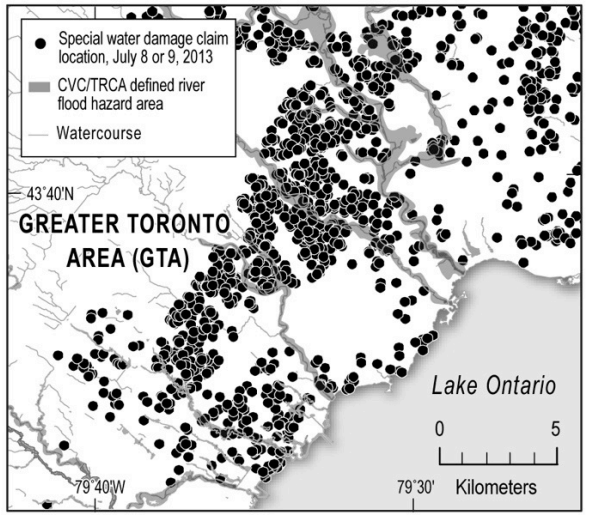
Wildfire





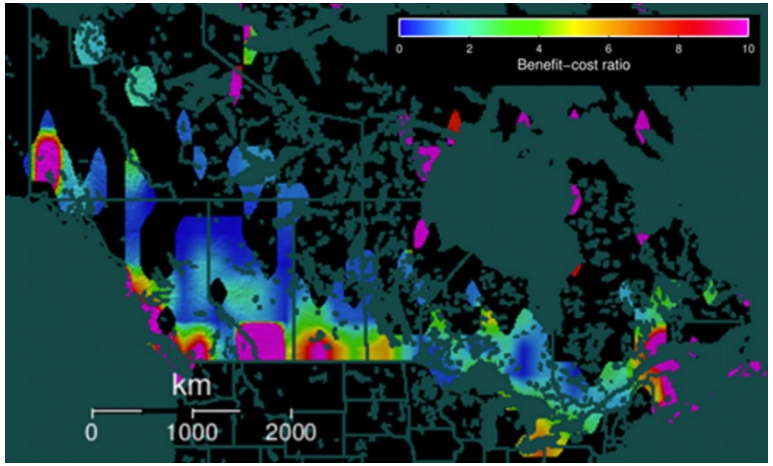
Conditional Fire Risk: "This layer addressed the relative risk to a building, whether a building actually exists at that location or not." **Erni, Sandy, et al. "Mapping wildfire hazard, vulnerability, and risk to Canadian communities."** ***International Journal of Disaster Risk Reduction*****. 101(2024).**

Urban, basement flood



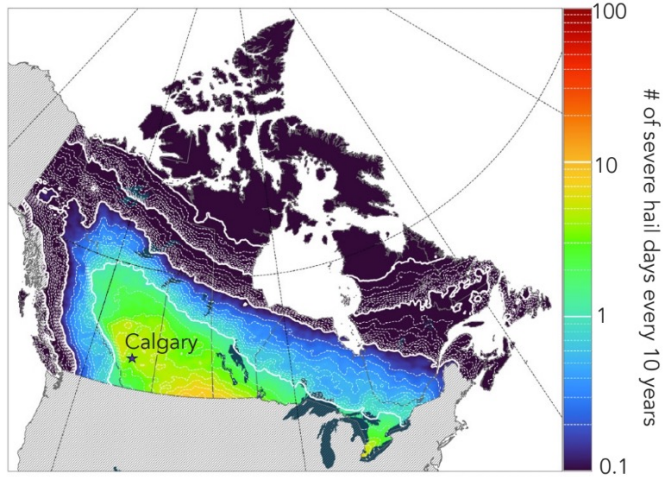
Sandink et al., 2016

High Wind



Porter, 2023

Hail



Map adapted from: Brunet, D., & Brimelow, J. (2024). A Hail Climatology for Canada Using a Lightning Proxy. *Journal of Applied Meteorology and Climatology*, *63*(10), 1227-1240.

Resilient Homes Task Force (2024-2025)

Resilient Homes Task Force

Home Building Industry (appointed by CHBA)

Alex Miller (Co-Chair)	CEO, Big Block Construction
Rick Weste	President & CEO, Triple M Housing
Cassidy deVeer	President, 3rd Generation Homes
Carl Pawlowski	Senior Manager, Sustainability, Minto Communities Canada
Bob Deeks	President, RDC Fine Homes
Peter Darlington	Solar Homes Inc.

Insurance Industry (appointed by ICLR)

Susan Penwarden (Co-Chair)	Managing Director, Personal Lines, Aviva Canada
Lisa Guglietti	Executive Vice President & Chief Operating Officer, P&C Insurance Solutions, Co-operators
Anna McCrindell	SVP, Chief Operations Officer-East, Wawanesa
Dipika Deol	Senior Client Manager for Public Sector Solutions, Swiss Re
Craig Stewart	Vice-President, Climate/Federal, IBC
Peter Braid	CEO, IBAC

Timeframe	Short-term	Medium-term	Long-term
	Year 1	Year 2	2 to 5 years+ *(beyond TF timeline)*
Visions of Success	**Builders and insurers are ready to initiate pilot projects** and are well-versed in resilience options.	**Builders and insurers understand cost-effective options;** Pilot projects facilitate wider adoption; Resilience options are endorsed by insurers.	**Builders and insurers are ready to drive and facilitate widespread adoption of resilience** throughout the entire homeowner supply chain, nationwide.
	Creation and development	**Dissemination and integration**	**Persuasion and mass adoption**
	1. Guidance documents for builders 2. Collaboration for builder training 3. Paper pilots for resilience integration	1. Strategy to facilitate adequate number of builders well-versed in resilience measures 2. Authentication of essential technical details (e.g., costing) from residential resilience pilots	1. Nationwide training of builders 2. Mass adoption of residential resilience across Canada
	4. Home resilience promotion materials	3. Strategies for increasing demand from homeowners	3. Consistent implementation of resilience literacy
	5. Standardized criteria for resilience labels 6. Evaluation of incentives for resilience labels	4. Addition of resilience into the Net Zero label 5. Work toward insurance endorsement of builders and the resilience label	4. Insurance industry policy endorses resilience-certified builders 5. Industry adoption of resilience incentives
	7. Policy and funding proposals 8. Public communication of Task Force and its objectives	6. Calls to action towards regional collaborators, industry and governments 7. Press releases of Task Force's project developments	6. Institutionalization of residential resilience nationwide

Stay agile and responsive, and always be on the outlook for potential disruptions that could require project adjustments, accelerate adoption and uptake, while **ensuring ongoing relevance and effectiveness** by rapidly responding to market signals.

Good, Better, Best

Resilient Homes Task Force

Primary Goals: Builder Education/Engagement, Risk Reduction, & Constructability

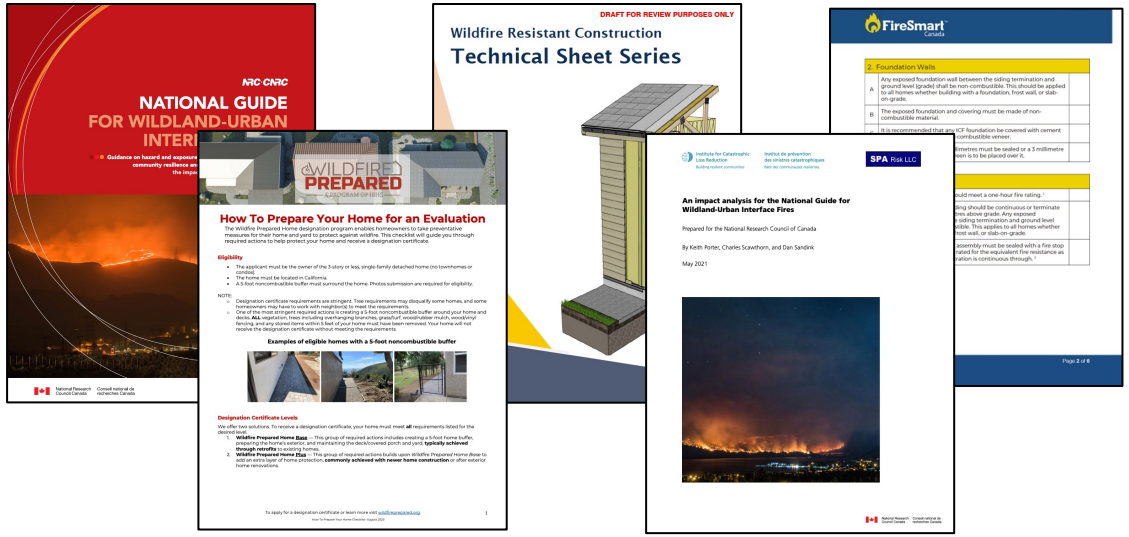
Good	Better	Best
• Address *recurring* vulnerabilities • Independent of "municipal-side" or landscape intervention • "Low risk" to builders: Technically mature, already in codes (inconsistently applied), routinely applied in some jurisdictions, currently incentivized by (some) insurers • Likely applicable anywhere in Canada/across hazard areas • Comparatively low complexity and cost	• Enhance performance of "basic" options • Some application in Canada; concepts based on research, lab assessments • Measures may be more costly or technically complex when compared to "basic" options • Cost, practicality – may not be fully assessed of all options	• Full adherence to comprehensive guidelines, standards • Emphasis on performance of buildings during extreme weather events • Some solutions "still in development" or experimental – field trials inform updates to standards, guidelines

How are we arriving at the tiered lists?

1. Guidelines, Standards, and BCAs
2. RHTF Pilot Working Group (and additional consultation)
3. Detailed Building and Insurance Industry Resilience Options Surveys
4. Builder Field Trials
5. Insurance Industry Guidance – including available “incentives”
6. Market Research

Standards, Guides, Benefit-Cost Assessments

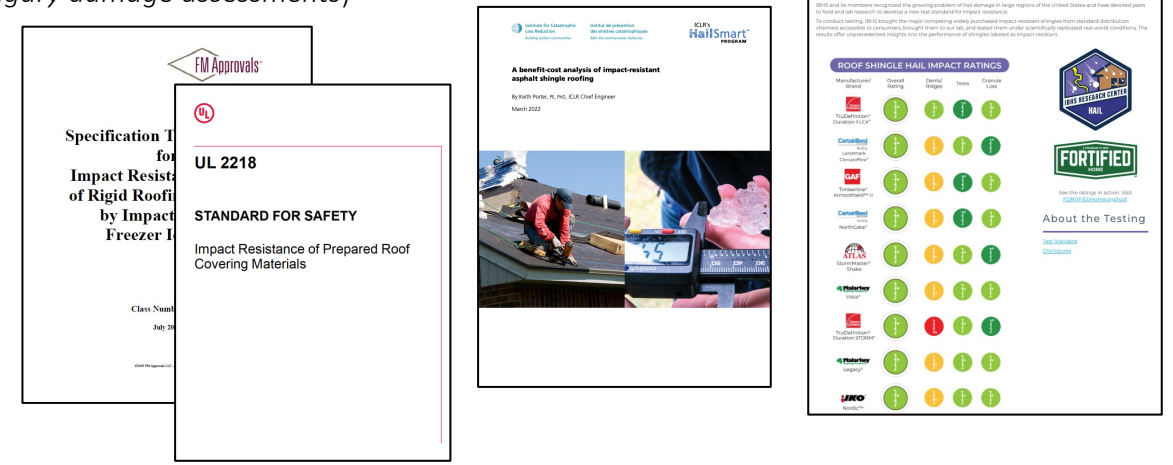
Wildfire



Urban, basement flood

High Wind

Hail (*comprehensive guidance developed for RHTF, based on Calgary damage assessments*)



RHTF, PWG

Resilient Homes Task Force

Pilot Working Group: General guidance; "Paper Pilots"; How to design guidance documents useful to builders, trades, construction managers

Topic area leaders, co-authors, reviewers of resilience recommendations

RHTF Pilot WG: Mattamy, Minto, Avalon, RDC, DTL, 3rd Gen., Curo, Aviva, TDI

Wildfire: **RDH**, FireSmart Canada, Big Block Construction

High wind: **CWC**, **DTL**, Western U/NTP, Co-op

Hail: Western U/**NHP**, Travis Engineering, ICLR, Co-op

Basement flood: **ICLR**, Co-op

General partners, sponsors: NRC, SCC, NRCan LEEP, TDI, Co-operators, Aviva

Example: Initial Iteration of Builder Tiered Checklist(s)

Contact: Dan Sandink, ICLR – dsandink@iclr.org

ID	Measure	Good	Better	Best
ED1	Downspouts are not directly or indirectly connected to sanitary or combined sewer systems.	✓		
ED2	Where downspouts discharge over the surface of the ground, discharge should be directed over a splash pad (or equivalent), and drained over a permeable surface, toward appropriate infrastructure (e.g., swales), **AND** downspout discharge should not create risk of icing on sidewalks, walkways, etc., and should not adversely affect neighbouring properties.	✓		
ED3	Where downspouts discharge over the surface of the ground, discharge points should be extended beyond the line of excavation and backfill.	+	✓ (Add to ED2)	
ED4	Where downspouts discharge over the surface of the ground, discharge points should be at least 1.8 m from foundation walls.	*/+	*/+	✓ (Add to ED2, replaces ED3)
ED5	Incorporate methods to reduce build-up of debris in eavestroughs (e.g., gutter guards)	-	-	✓
ED6	Where downspout collection pipes are fastened to foundation walls, they should be fastened in a manner that reduces risk of dislocation or damage during backfill. Note: Practices are adapted from BNQ 3682-320, section 5.3.2.5.6., and include: • Use 19 cm (7.5") wide, 20-gauge galvanized steel straps; • Use a concrete anchor sleeve 6.35 mm by 31.75 mm (1/4" by 1 ¼") or equivalent; • Place straps with 25.4 cm [10 in] wide PVC saddles and anchors on the pipe (saddles not required for black ABS Schedule 40); • Leave a maximum spacing of 40.64 cm (16") for depts of up to 1.22 m (4') between straps; • Leave a maximum spacing of 30.48 cm (12") for depts of 1.22 m (4') to a maximum depth of 1.83 m (6') between straps; • Install at least one strap at all horizontal fittings. ***This measure does not apply where downspouts drain to grade.***	-	-	✓
EP	**Infiltration and Overland Flood Entry Points**			
EP1	Cracks in foundation walls and/or basement floors are sealed to reduce the risk of infiltration flooding/seepage.	-	✓	
EP2	Identify and seal any potential overland flood entry points that are located at a height of 5 cm above the adjacent lot surface (final grade) or lower. Entry points may include: Gaps between foundation walls and framing around windows and doors, gaps around piping or wiring, conduit penetrations in foundation walls, cracks in brickwork (weep holes in brick walls should be located such that they do not permit entry of surface water). *Note: Where possible, identify and seal any openings that may be inundated by a 1 in 100 year local stormwater accumulation event (accounting for climate change impacts).*	-	✓	
EP3	Foundation penetrations are at least 5 cm above the adjacent lot surface (final grade). *Note: Where possible, identify and seal any openings that may be inundated by a 1 in 100 year local stormwater accumulation event (accounting for climate change impacts).*	-	+	✓ (Add to EP2)
EP4	Minimum elevations for building entrances should be above the predicted flood elevation or spillover elevation in the street, lane, or parking lot adjacent to a dwelling, plus necessary freeboard tolerances as specified by the AHJ.	-	-	✓
FD	**Foundation Drainage Systems**			

Building/Insurance Industry Surveys (separate surveys for each industry)

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Builder-Insurer Impact Matrix			Insurer: Claims Reduction Effectiveness			
			1	2	3	4
			Not effective	Somewhat effective	Effective	Extremely effective
Builder: Implementation Likelihood	1	Unlikely	2	3	4	5
	2	Possible	3	4	5	6
	3	Likely	4	5	6	7
	4	Very likely	5	6	7	8

8 7 6 5 4 3 2

#	Measure	#	Measure	#	Measure
1	N. RS Driveway	12	Seal Pen.	23	SP AH Rating
2	N. Cross Connections	13	Pen. >5 cm	24	SP Capacity
3	Exag. Backfill Grade	14	Min. Elevation - Entrances	25	SP Secondary
4	Backfill Cap	15	Groundwater Areas or Slab on Grade	26	SP Discharge Ext.
5	Exterior SW (A)	16	FD Discharge (not to sanitary, combined)	27	FD Gravity Discharge
6	Exterior SW (B)	17	FD Backwater Protection	28	Sanitary BWV
7	DS (A)	18	FD Protect from Blockage	29	BWV Enhanced Grade
8	DS (B)	19	FD Access for Maintenance	30	Sewer Lateral 2%
9	Window Wells	20	FD BF Protection (Enhanced)	31	Maintenance Info
10	DS Collector to Foundation	21	SP Submersible, CV, Recept.		
11	Fill Cracks	22	SP Backup/Alarm		

#	Measure	#	Measure	#	Measure
1	Roof: Class 4	10	Siding: Better/IR Siding	19	Windows: Non-Vinyl
2	Roof: IBHS Rated	11	Siding: Missile Resistant	20	Windows: Drip Caps
3	Roof: High End Class 4	12	Vents: Class 4 Vents	21	Gutters: Alum./Guards
4	SWB: Type II underlay	13	SL: No Acrylic	22	Gutters: Steel/Guards
5	SWB: Synthetic underlay	14	SL: Tempered or Polycarbonate	23	PV: IEC Test
6	SWB: Tape Roof Deck Joints	15	SL: Missile Resistant	24	PV: Enhanced Test 1
7	SWB: Synthetic and Tape Joints	16	Windows: Missile Resistant	25	PV: Enhanced Test 2
8	SWB: Full Course SAM	17	Windows: Films		
9	Siding: Non-Vinyl	18	*Windows: Additional Suggestions*		

Surveys completed for high wind, hail, basement flood – WUI fire to be issued soon

ICLR, CHBA Builder Field Trial/IDP Projects

IDP Sessions; Detailed Technical Discussions – Designers, PMs, Buyers, etc.

<u>IDP Sessions:</u>

Context: ICLR

WUI Fire: FireSmart/RDH

Hail/Wind: NHP/CWC

Basement Flood/Wind: ICLR/NTP/CWC

Exercise 1:

Rate each resilience option:

- Design impact
- Constructability
- Owner acceptance
- Hard cost
- Maintenance

Exercise 2:

- Rank priority for field trial project

Wildfire session

FireSmart Canada **Landscaping** Checklist: **<u>Analysis</u>** Rating: 3 High / 2 Med / 1 Low	Initial Design Impact	Impact on Constructability	Owner Acceptance	Cost (Hard Cost)	Maintenance-On Going
7.) Plant a low density of fire-resistant plants & shrubs (Review FireSmart Plant recommendations)	3	1	1.5	1	1
8.) Landscaping materials should not include any woody debris including bark mulch	3	1	1.5	1.5	1.5
9.) Grasses should be watered and maintained to 10cm height or less	3	1	1	1	1
10.) Combustible debris items such as firewood piles, propane tanks, storage sheds and ancillary structures should be at least 10m from structure. Other construction materials/debris /trailers/recreational vehicles should be kept	na	na	na	na	na

FireSmart Canada **Landscaping** Checklist: **<u>Priority</u>**	No Brainer	High Potential	Possible, more info req.	Non Starter (As written)	Comments
Decks & Other Minor Structures					
1.) Decks Arbors Gazebos and other landscape structures should be constructed of non-combustible materials where possible when located within 10m of any primary or secondary structure.		X			
FireSmart Planting Recommendations					
2.) Reference the FireSmart Canada Landscaping Guide for recommendations on plant selections and design guides by home ignition zone	X				Buyer expectations + Draft Plan Resubmit?
Fencing					

Hail/Wind session

Hail Resiliency: Project Analysis Exercise

1. For each criteria/item, rank on a scale of 1-3 (1 being low, 3 being high):

a. The impact on initial design
b. The ease of construction
c. Owner acceptance
d. Hard cost
e. Ongoing maintenance

ID	Measure	Initial Design Impact	Impact on Constructibility	Owner Acceptance	Cost(Hard Cost)	Maintenance-On Going
RC	**Roof Cover**					
RC1	Install Polymer-Modified Asphalt (PMA) shingle roof cover products that cover products that comply with UL 2218 or FM 4473 Class 4 impact resistance. See notes on full checklist	1	1	1	2	1
RC2	Asphalt roofing products rated by the Insurance Institute for Business and Home Safety (IBHS) as Good or Excellent impact resistance, according to the latest IBHS rating.	1	1	1	2	1
RC3	Install high-end impact resistant roofing products, including recycled rubber products, slate, concrete tile (i.e., high end products other than asphalt shingles), rated for UL 2218 or FM 4473 Class	2	2	1	2	1

Hail Resiliency: Project Priority Exercise

2. For the Landscaping Checklist – Project Priority exercise: For each criteria/item, select the most applicable priority rating:

a. Already applied/no brainer
b. Actively under review with the potential to apply
c. Possible, but requires additional information and review
d. Non-starter (as currently written)

ID	Measure	No Brainer (Already accounted for)	High Potential Actively Reviewing	Possible, but more info needed.	Non Starter (As currently written)	Comments
RC	**Roof Cover**					
RC1	Install Polymer-Modified Asphalt (PMA) shingle roof cover products that cover products that comply with UL 2218 or FM 4473 Class 4 impact resistance. See notes on full checklist		X			W/ PV - Needs removal before replacing shingles
RC2	Asphalt roofing products rated by the Insurance Institute for Business and Home Safety (IBHS) as Good or Excellent impact resistance, according to the latest IBHS rating.			X		As Available
RC3	Install high-end impact resistant roofing products, including recycled rubber products, slate, concrete tile (i.e., high end products other than asphalt shingles), rated for UL 2218 or FM 4473 Class 4 impact resistance. See notes on full checklist				X	Affordability
SWB	**Secondary Water Barrier**					

Wind/Basement flood session (and hail)

Basement Flooding: Project Priority Exercise

2. For the Landscaping Checklist – Project Priority exercise: For each criteria/item, select the most applicable priority rating:

a. Already applied/no brainer
b. Actively under review with the potential to apply
c. Possible, but requires additional information and review
d. Non-starter (as currently written)

ID	Measure	No Brainer (Already accounted for)	High Potential Actively Reviewing	Possible, but more info needed.	Non Starter (As currently written)	Comments
ED	**Eavestroughs and Downspouts**					
ED1	Downspouts are not directly or indirectly connected to sanitary or combined sewer systems.	X				
ED2	Where downspouts discharge over the surface of the ground, discharge should be directed over a splash pad (or equivalent), and drained over a permeable surface, toward appropriate infrastructure (e.g., swales), **AND** downspout discharge should not create risk of icing on sidewalks, walkways, etc., and should not adversely affect neighbouring properties.	X				
ED3	Where downspouts discharge over the surface of the ground, discharge points should be extended beyond the line of excavation and backfill.			X		
ED4	Where downspouts discharge over the surface of the ground, discharge points should be at least 1.8 m from foundation walls.			X		
ED5	Incorporate methods to reduce build-up of debris in eavestroughs (e.g., gutter guards)				X	
ED6	Where downspout collection pipes are fastened to foundation walls, they should be fastened in a manner that reduces risk of dislocation or damage during backfill.			X		N/A for this building

Wind Resiliency: Project Analysis Exercise

1. For each criteria/item, rank on a scale of 1-3 (1 being low, 3 being high):

a. The impact on initial design
b. The ease of construction
c. Owner acceptance
d. Hard cost
e. Ongoing maintenance

ID	Measure	Initial Design Impact	Impact on Constructibility	Owner Acceptance	Cost(Hard Cost)	Maintenance-On Going
RC	**Roof Cover (asphalt shingle, steep slope roofing)**					
RC1	Install roof cover rated for 120 mph wind gusts (e.g., ASTM D7158 Class G or higher), **AND** Install asphalt shingles with a minimum of six fasteners per full length of shingle (or the manufacturer's recommendation for high wind regions), **AND** Install shingles with fastener pull-through resistance of at least 30 lb (0.13 kN). See notes on full checklist	1	1	1	3	1
RC2	Install asphalt shingles at 10 °C or warmer, unless the manufacturer permits otherwise.	1	3	1	3	1
RC3	Asphalt shingles are hand sealed (cemented) across entire roof deck.	1	3	1	3	1

Sessions Moderated by Building Knowledge Canada

Insurance “Incentives”

Hazard

	Premiums	Deduct.	Caps (Sub-Limits)	Avail.	Deprec. Schedules	Insurer Subsidy
High Wind					✓	✓
Hail	(✓)	(✓)		(✓)	(✓)	(✓)
Water/ Flood/SB	✓	(✓)	✓	✓		✓
Wildfire	(✓)	(✓)		(✓)	(✓)	

✓ – At least one national insurer in Canada.

(✓) – Applies to some markets/<u>co-benefits with other hazards</u>

All of the above highly dependent on insurer

we will pay additional costs for the use of **eco-efficient material** or **resilient material** in

Resilient material means materials and products that are more resistant to damage and durable than the materials or products that were damaged, which include, but are not limited to:

- Roof and structural strapping;
- Hail resistant shingles;
- Impact resistant windows and doors;
- Water leakage detector;
- Cover for gutters.

AVIVA

Affected materials

The age adjusted cost factor will be applied to the following materials in an insured loss:

- ✓ Asphalt shingles (excluding Class 4 Hail Resistant)
- ✓ Flat roofs made of tar and gravel or membrane
- ✓ Vinyl and or aluminum siding

Protect your home. Save money.

The FireSmart BC Wildfire Mitigation Program is pleas to partner with the insurance providers listed below. If your insurance policy is through one of the following providers, you may be eligible for savings upon completion of an assessment and FireSmart certification.

BCAA CAA co-operators

co-operators

Where applicable, following an insured loss, *TomorrowStrong™ coverage provides reimbursement of up to:

- $3,000 for eligible resilient roofing upgrades
  - Roofing materials and installations that have a Class 4 impact rating (withstands hail up to 2 inches in diameter) and/or Class G or H wind rating (withstands winds of up to 193 kph and 241 kph) and a Class A Fire rating (fully fire resistant).

:tion between a roof truss and wall plate to prevent uplift.

led to security system, sump pump, water alarm, and surge

Wawanesa

Stronger Home coverage

We will pay the increased cost to repair or replace your roof or exterior siding with more resilient materials when a loss occurs.

Additional limit	Premium
$25,000	Varies by region

Market Research: Determination of Costing

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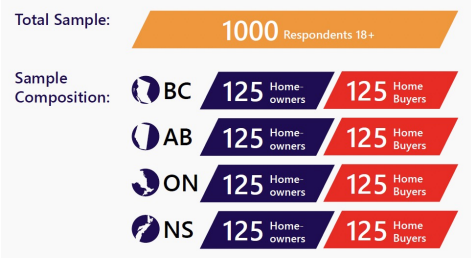
Nov. 2024; 1,000 respondents: 125 homeowners & home buyers in: South/central BC (wildfire); Calgary area (hail, urban flood); GTA (wind, urban flood); Halifax region (wind, flood).



Willingness to invest

Hazard	Owners	Buyers
Wind	75%	81%
Wildfire	69%	86%
Flood	67%	79%
Hail	62%	78%

Owners: Willingness to invest

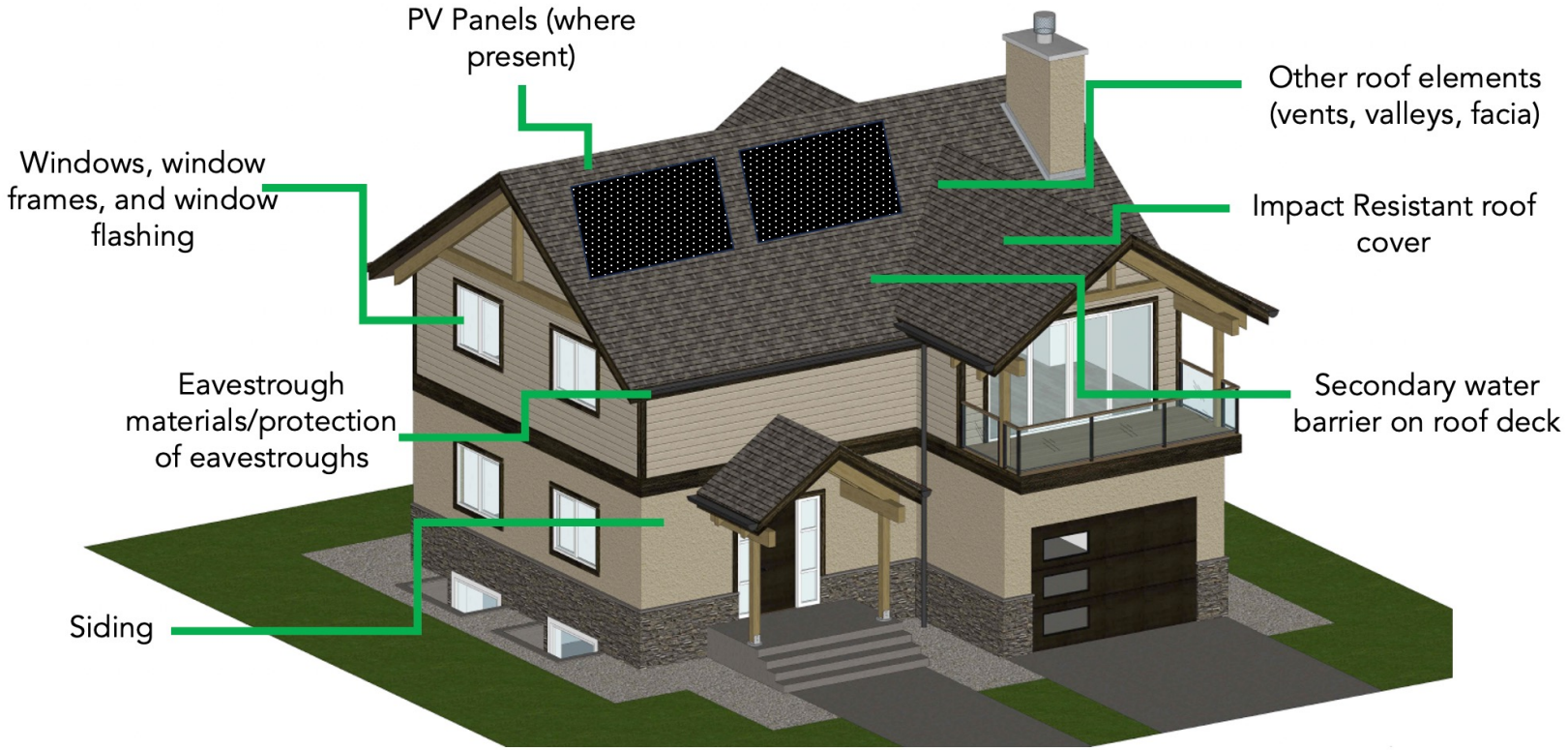
Amount	Hail	Wind	Flood	Wildfire
$5000+	55%	48%	47%	45%
$10,000+	26%	44%	42%	40%
$25,000+	8%	4%	5%	5%

Buyers: Willingness to invest

Amount	Hail	Wind	Flood	Wildfire
$5000+	46%	51%	50%	50%
$10,000+	42%	46%	44%	43%
$25,000+	4%	5%	6%	7%

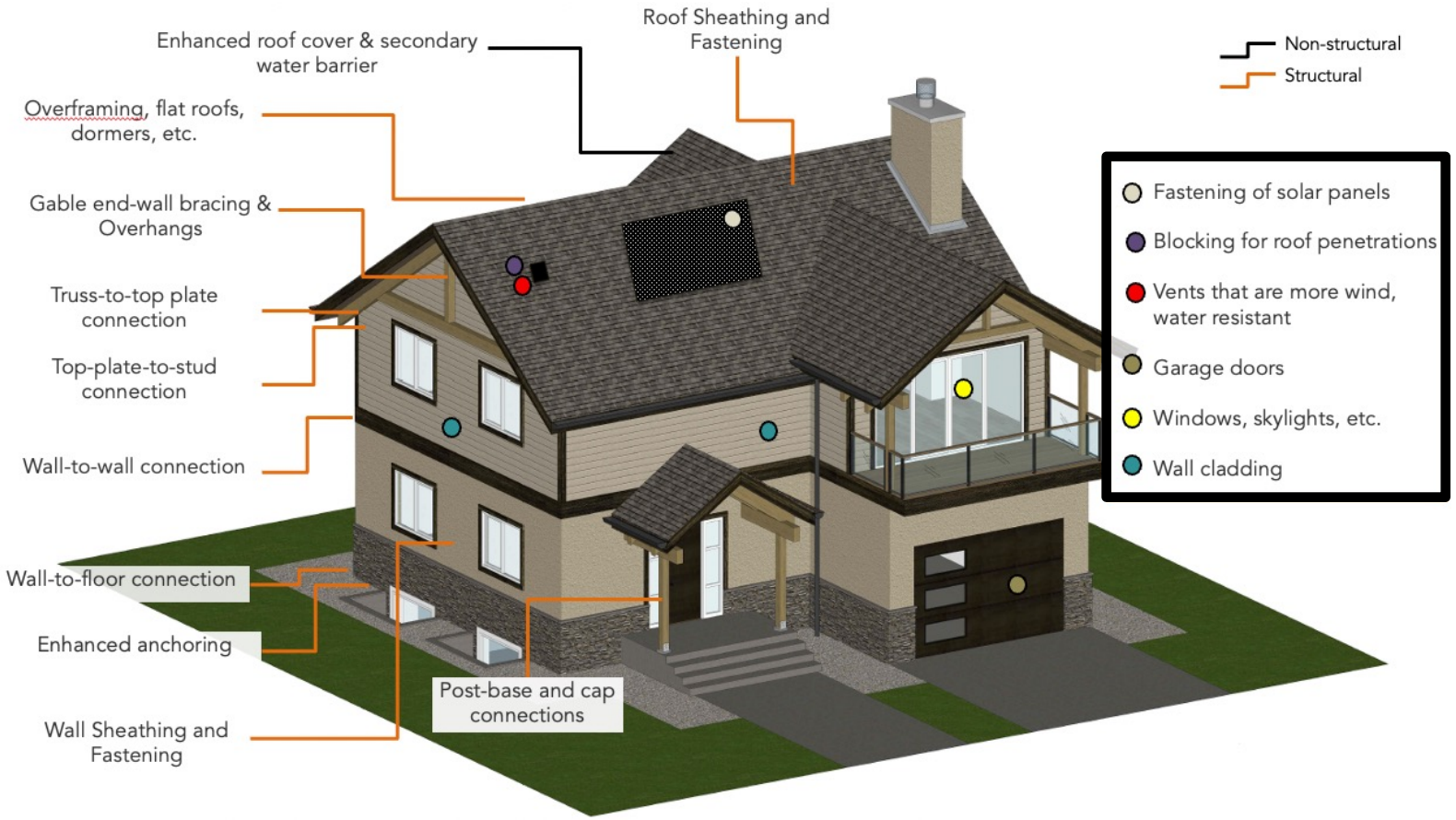
Tiered Options

Hail



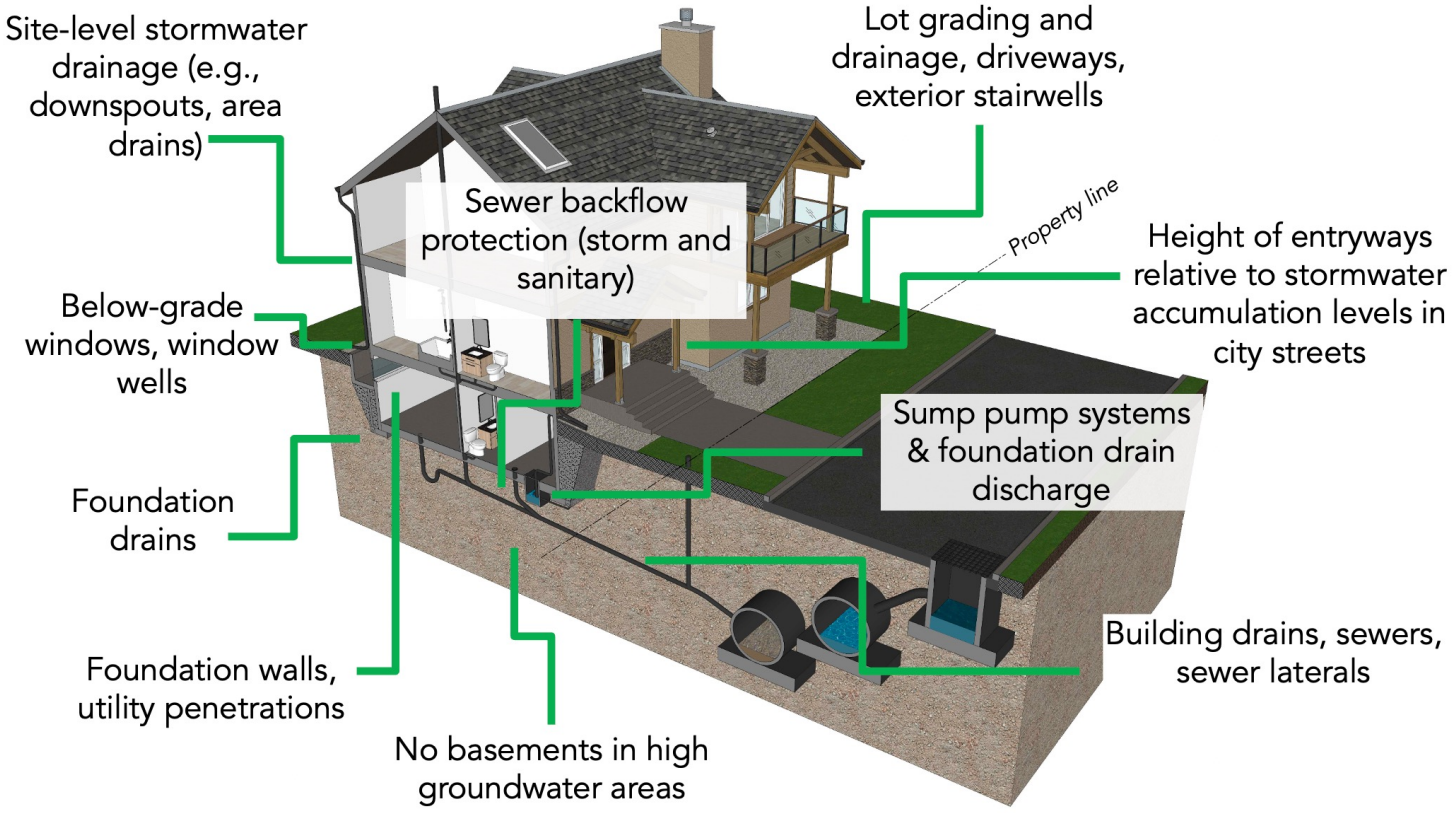
- Class 4 IR roof cover, “better” siding, no acrylic skylights, minimum IEC testing standard for PV
- “Better” (IBHS rated) roof cover, secondary water barrier, tempered/polycarbonate skylights, metal eavestroughs with guards, higher standards for PV
- High-end Class 4 roof cover products, fibre-cement, stone, etc. siding, roof vents, address windows (glazing, trim, drip caps), heavy gauge steel gutters

High Wind



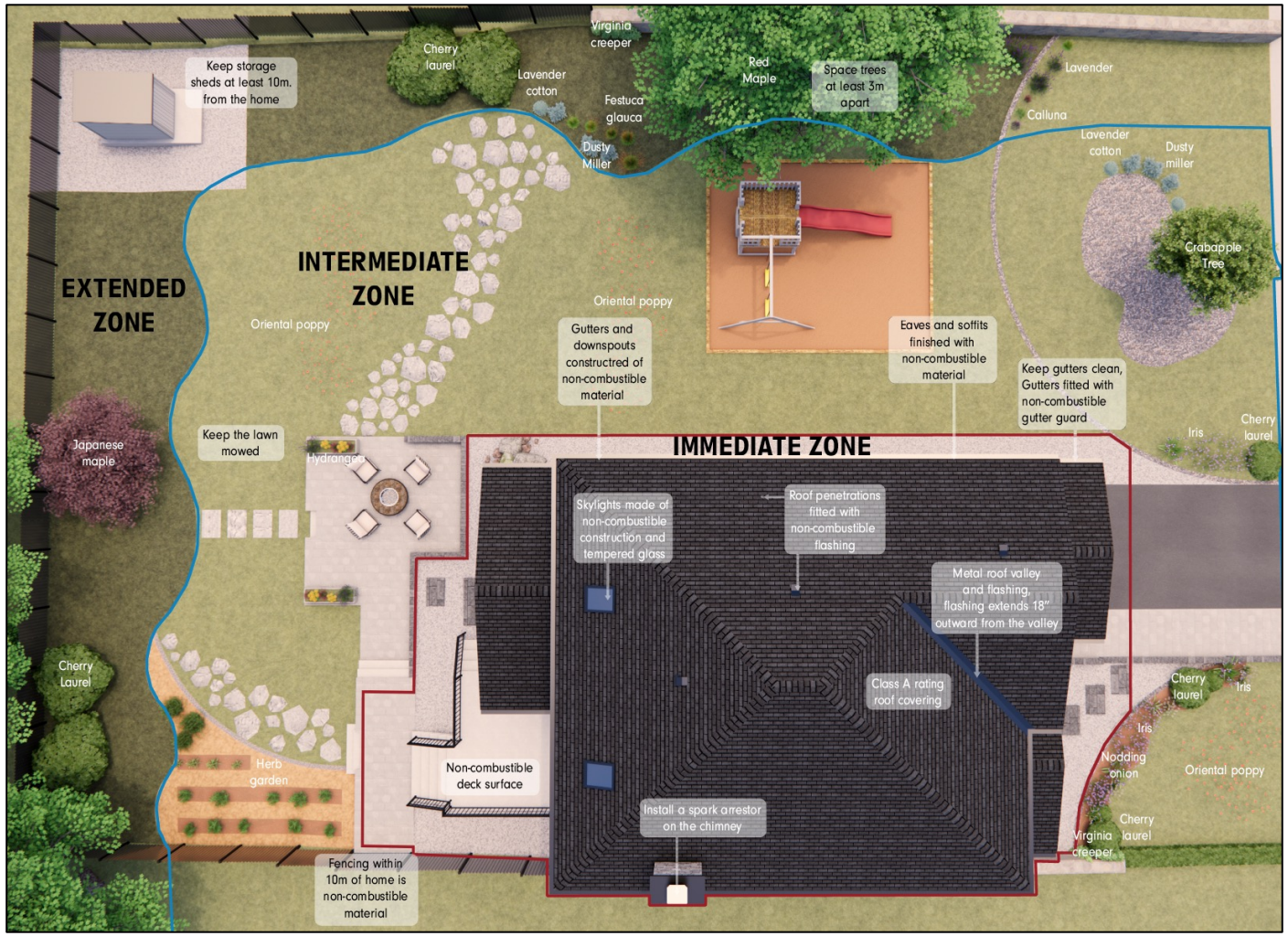
- High wind resistant roof cover, secondary water barrier, roof sheathing fastener patterns, roof-to-wall connections
- Basic vertical load path, enhanced secondary water barrier, items routinely applied but more costly (e.g., better siding)
- Full compliance with CSA S520: The above plus comprehensive bracing, fenestration, doors, siding, “enhanced” vertical load path

Urban/Basement Flood



- Do not locate in known flood hazard area (river, coastal, groundwater), lot grading and drainage (inc. stairwells, driveways), no cross-connections, backup power for sumps (where present), sewer backflow protection
- Enclose stairwells (where present), address window wells, utility penetrations, provide access to FD for maintenance, appropriately sized sump pumps (where present), steeper grade on BWVs
- Full application of CSA Z800 and some additional enhancements

Wildland Fire (DRAFT)



- Roof cover & elements that result in ignition of debris immediately next to the building, fire spreading into attic; "constructable" options
- Additional roof details, eaves and soffits, venting, siding, flashing, fire resistance in walls (where necessary), decks, elevated structures, windows & doors
- Comprehensive application consistent with NRC WUI Guide CC1. Consistent with new FireSmart Development Guide.

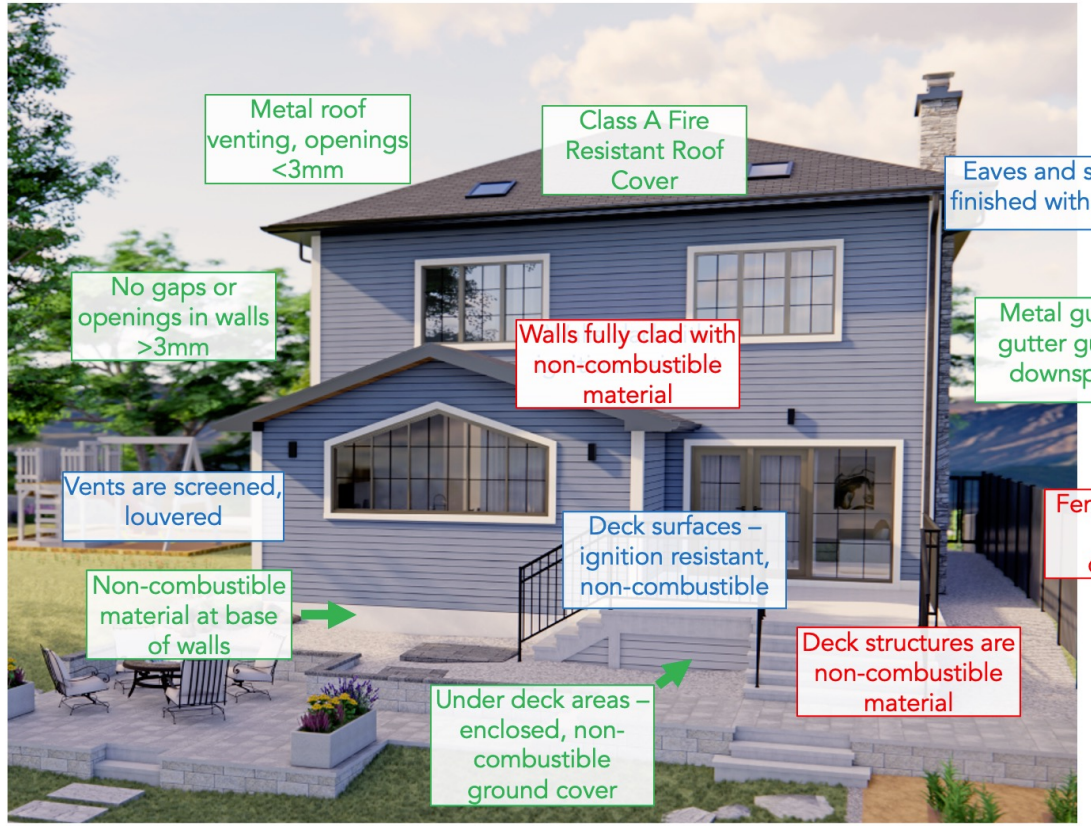
Tiered options: RDH BUILDING SCIENCE

Next Steps

Communicating to Builders & Buyers

Images: ICLR

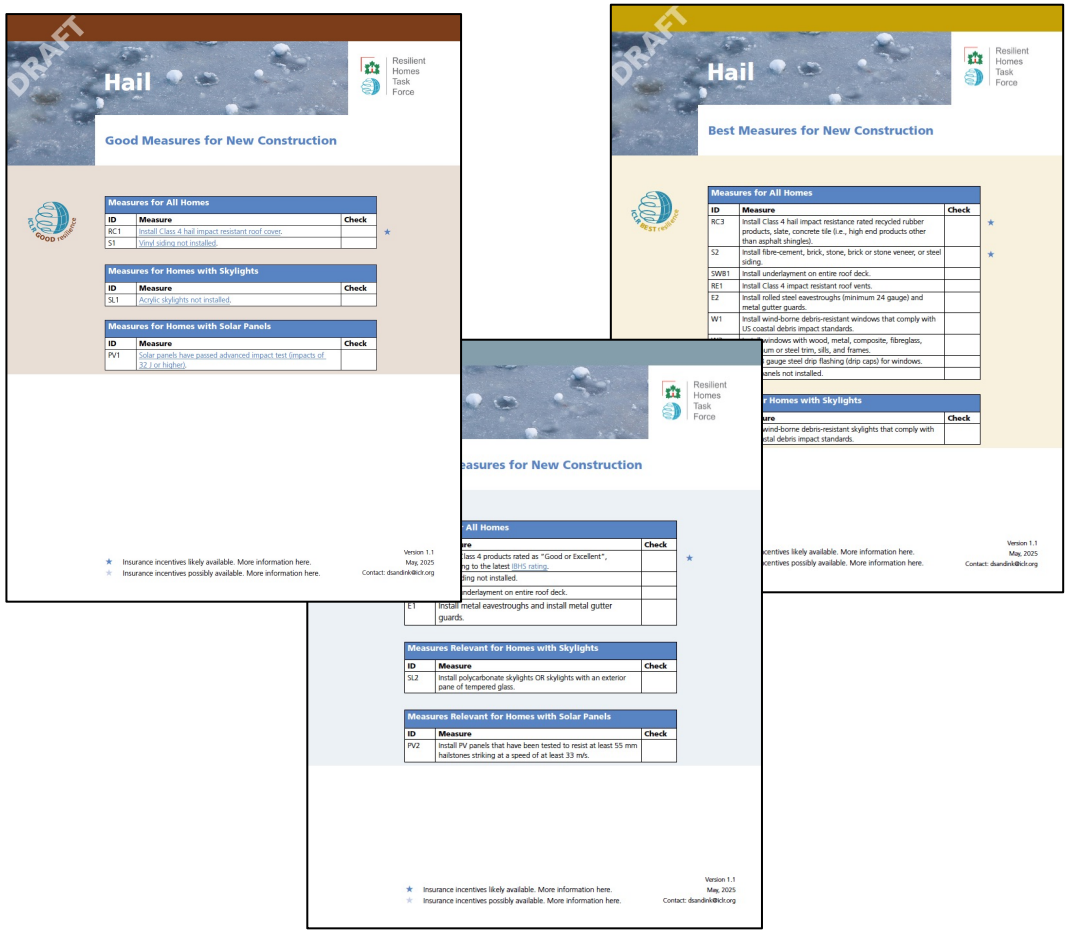
It’s not all concrete!



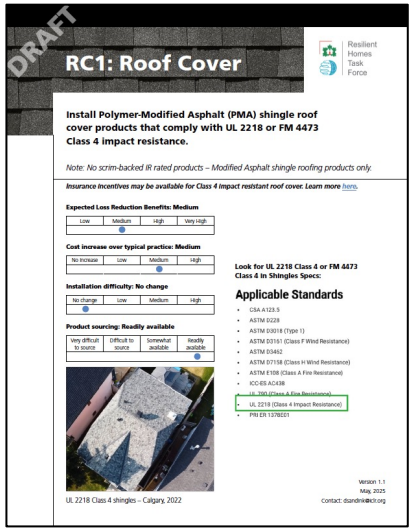
Images: ICLR

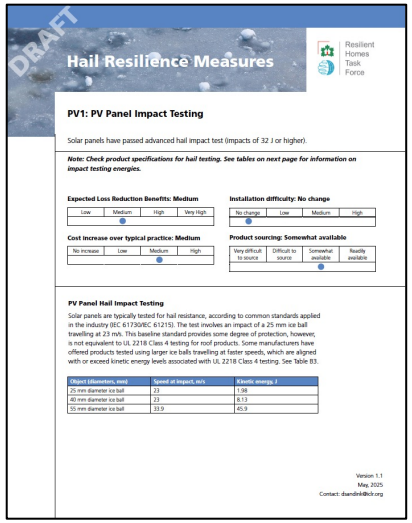
Outputs (year-end): Guides, Justification, 3D Diagrams

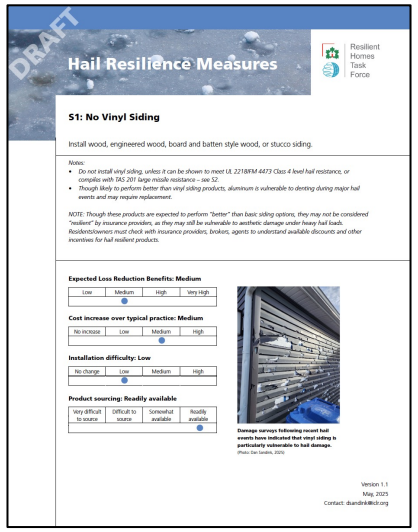
High level resilience checklists

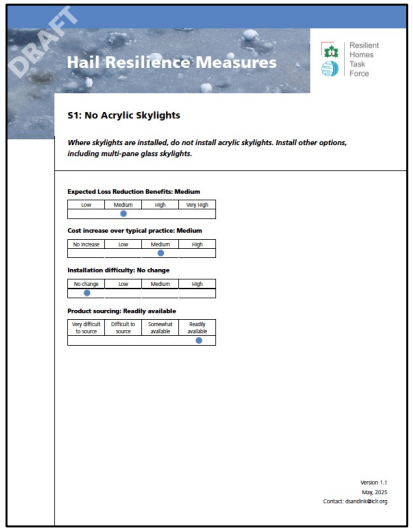


Supporting Documentation









RHTF – Next Steps

ICLR/CHBA Resilient Homes Task Force:

- Ongoing field trial projects in Fernie, BC (wildfire), Calgary (wind, hail), S. Ontario (urban flood, wind).
- Guidelines, market research, etc. to be complete by end of 2025 (NRC & SCC Contracts).
- CSA Z800 update, WUI Fire Guide-based standard – RHTF outputs/findings will be integrated.

Beyond 2025:

- ICLR developing ongoing building industry partnership with a **focus on field trial projects**. Further development of guidance documents should be based on actual implementation of resilience options. Expand into multiple sectors beyond RHTF (2026-2030).

Resilient Homes Task Force

Thank you! Contact: dsandink@iclr.org