

8

Appendices



Appendix A – Content Items and Prices

Content Items and Prices - Price Suppliers (4,000 individual item prices)

Amber's Furniture	IKEA
Ashley Furniture Homestore	JYSK
Atlas Appliance Expert	Lamps.com
babies'R'us	Lane Home Furnishings
Bass Pro Shops	LaZboy Home Furnishings
Bed Bath Home	Leon's Furniture
BestBuy	London Drugs
Birchwood Furniture	Lowe's
Galleries	Major Appliances Inc.
Bombay Company	McArthur Fine Furniture
Bondars Furniture	Mountain Equipment Co-op
Canada Mountain Bike Shop	Office Depot
Canadian Tire	Pooltables.ca
Consumer Reports	PotteryBarn
Costco	Restoration Hardware
Crate & Barrel	Sears
Cricklewood Interiors	SleepCountry
Crossroads Furniture Gallery	SportChek
Dell	Staples
Eisenberg's Fine Furniture	Structube Furniture
Fitness Depot	Target
Furniture Depot	The Brick
Future Shop	The Home Depot
Giant Bicycles	The Source
Hockey Plus	Urban Barn
Home Outfitters	Visions Electronics
Honda Power Equipment	Walmart
Hudson's Bay	Wickerland

Content Items and Prices - Inventory Items

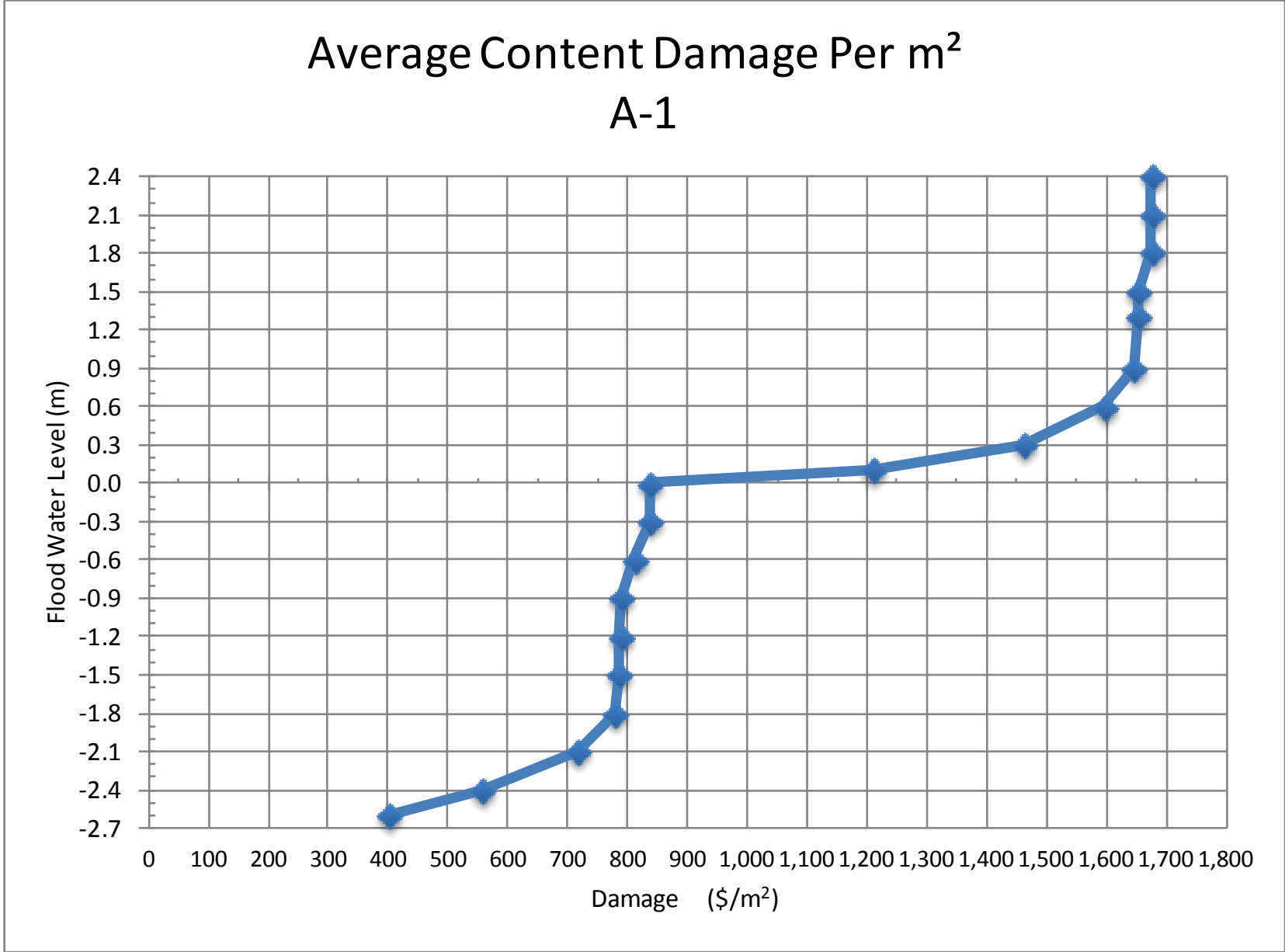
	LOW Mean 1	MEDIUM Mean 2	HIGH Mean 3	Mean All
Art / mirror on wall	\$100	\$250	\$750	\$367
BBQ	\$210	\$433	\$1,119	\$567
Bed head/footboard	\$451	\$917	\$2,751	\$1,318
Bed mattress	\$651	\$1,196	\$2,265	\$1,342
Bicycle	\$223	\$450	\$2,962	\$1,131
Bookcase linear meters	\$702	\$1,493	\$2,511	\$421
Camera / video	\$133	\$257	\$933	\$420
Camping gear set	\$459	\$693	\$1,007	\$712
Chest of drawers	\$879	\$1,632	\$3,225	\$2,008
Clothing closet linear meter	\$1,402	\$2,625	\$5,240	\$3,089
Clothing steamer	\$153	\$153	\$153	\$153
Coffee machine	\$88	\$144	\$1,041	\$395
Computer desktop	\$574	\$851	\$1,330	\$906
Computer laptop	\$365	\$612	\$1,198	\$709
Computer tablet	\$204	\$391	\$724	\$431
Cooktop / wall oven	\$3,060	\$3,780	\$5,992	\$4,213
Dining chair / table set	\$558	\$1,257	\$3,085	\$1,582
Dishwasher	\$496	\$734	\$1,626	\$925
Footstool / ottoman	\$82	\$151	\$597	\$263
Freezer	\$993	\$1,311	\$1,908	\$1,388
Furniture wall unit linear meters	\$1,402	\$2,625	\$5,240	\$3,089
Garden lawn mower / snow blower	\$301	\$494	\$1,296	\$673
Garden other power hand equipment	\$89	\$145	\$320	\$180
Iron & board	\$106	\$106	\$106	\$106
Kitchen equipment	\$84	\$216	\$442	\$250
Kitchen waste disposal	\$193	\$193	\$193	\$193
Lamp floor / table	\$53	\$146	\$348	\$177
Luggage set 3pc	\$119	\$255	\$470	\$276
Microwave	\$105	\$168	\$372	\$209
Musical instrument piano / organ	\$2,000	\$5,000	\$10,000	\$5,667
Musical instrument portable	\$1,000	\$3,000	\$5,000	\$3,000
Night stand	\$156	\$398	\$966	\$491
Occasional chair	\$221	\$451	\$1,120	\$578
Office chair	\$119	\$220	\$555	\$288

Content Items and Prices - Inventory Items

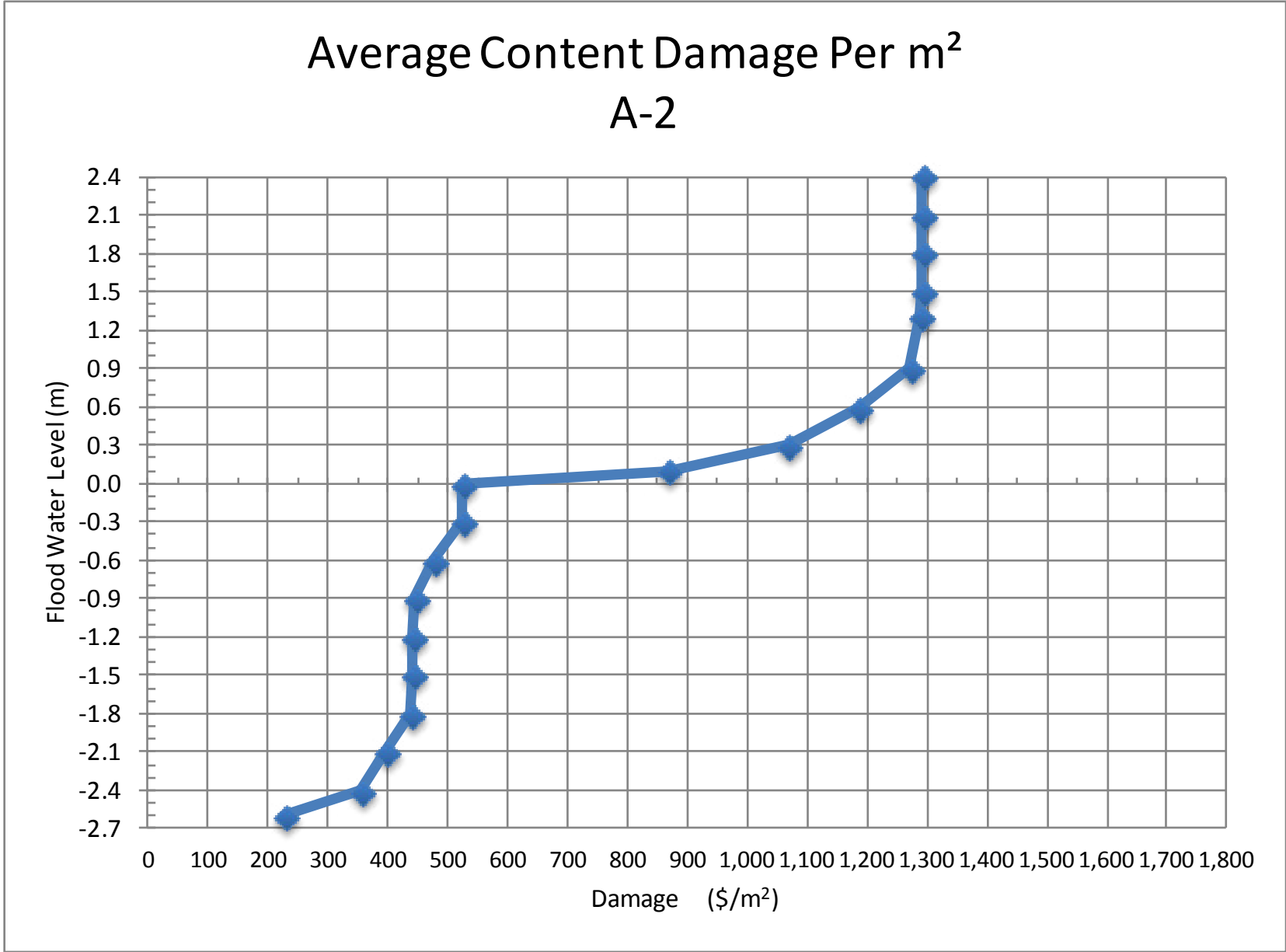
	LOW Mean 1	MEDIUM Mean 2	HIGH Mean 3	Mean All
Office desk	\$217	\$702	\$1,482	\$781
Office paper shredder	\$76	\$158	\$350	\$189
Office printer	\$79	\$142	\$344	\$182
Outdoor patio set	\$557	\$1,608	\$3,458	\$1,827
Pool / games table	\$304	\$935	\$2,895	\$1,321
Refrigerator	\$1,436	\$2,311	\$3,176	\$2,290
Rug area <5m2	\$226	\$562	\$951	\$579
Rug area 10+m2	\$1,089	\$2,140	\$5,755	\$2,961
Rug area 5-10m2	\$349	\$739	\$1,711	\$925
Sewing / serger machine	\$168	\$347	\$946	\$487
Sideboard	\$912	\$1,729	\$3,444	\$1,982
Sofa/love seat per position	\$271	\$455	\$899	\$530
Sound system equipment	\$244	\$417	\$941	\$519
Sound system headphones	\$62	\$180	\$335	\$188
Sound system speakers	\$142	\$293	\$834	\$407
Sports gear set	\$767	\$767	\$767	\$767
Storage shelving linear meters	\$272	\$272	\$272	\$272
Stove	\$870	\$1,400	\$2,232	\$1,480
Table accent/ end	\$139	\$295	\$954	\$443
Table coffee	\$182	\$359	\$858	\$452
Telephone set	\$83	\$83	\$83	\$83
Television DVR/ streaming hub	\$213	\$213	\$213	\$213
Television set	\$323	\$797	\$2,359	\$1,114
Treadmill / elliptical	\$546	\$1,532	\$2,873	\$1,619
TV / media bench / cabinet	\$226	\$763	\$2,437	\$1,093
Vacuum portable	\$162	\$335	\$563	\$348
Warming drawer	\$1,308	\$1,308	\$1,308	\$1,308
Washer / dryer set	\$1,199	\$1,738	\$2,572	\$1,816
Weight machine	\$641	\$1,452	\$3,720	\$1,873
Window covering to floor				
Window covering to sill				
Wine rack number bottles	\$10	\$19	\$38	\$22
Workshop bench / table	\$265	\$265	\$265	\$265
Workshop power tools / equipment	\$94	\$150	\$305	\$179
	\$472	\$867	\$1,760	

Appendix B – Residential Content Damage Curves

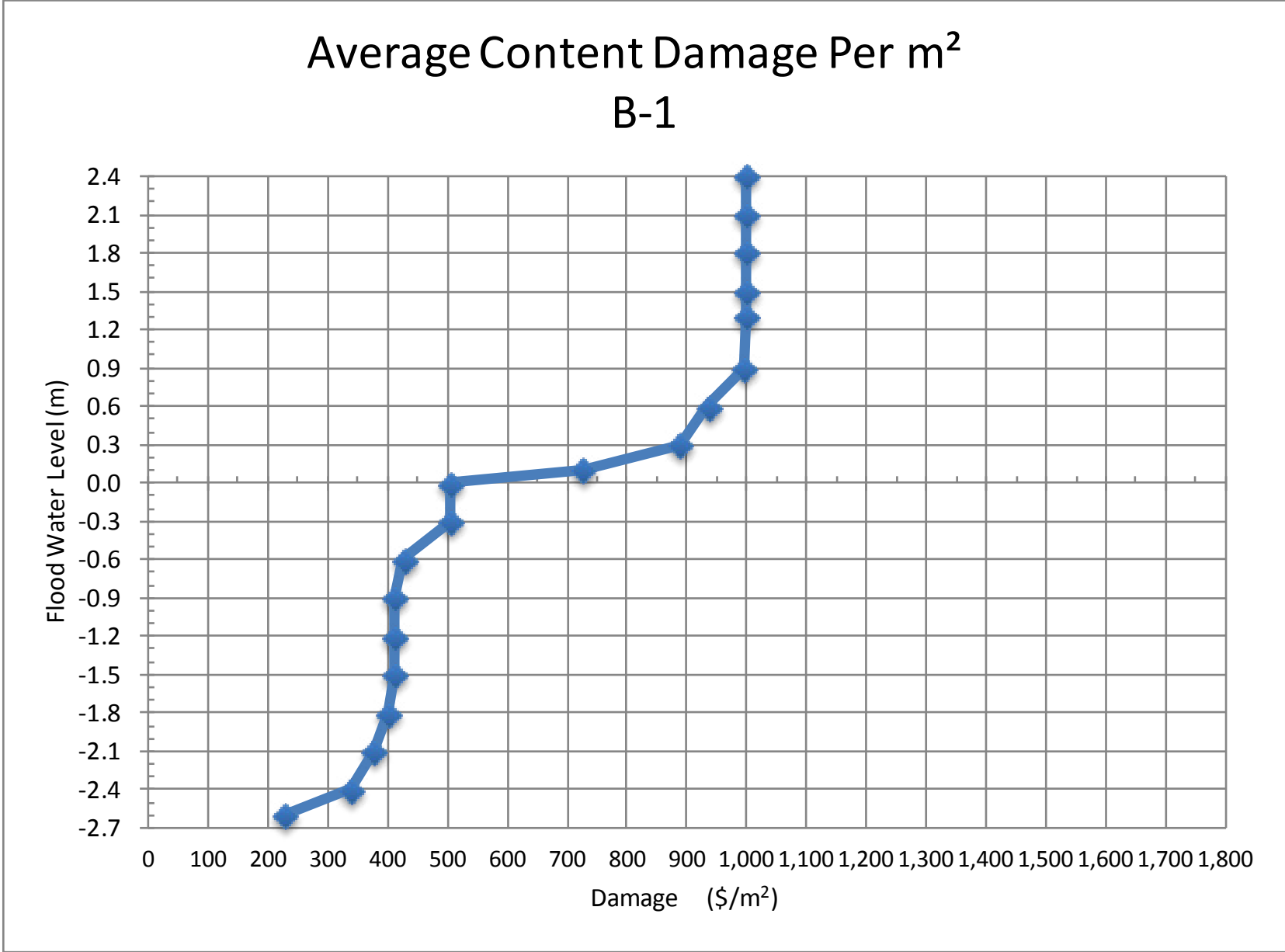
Average Content Damage Per m² A-1



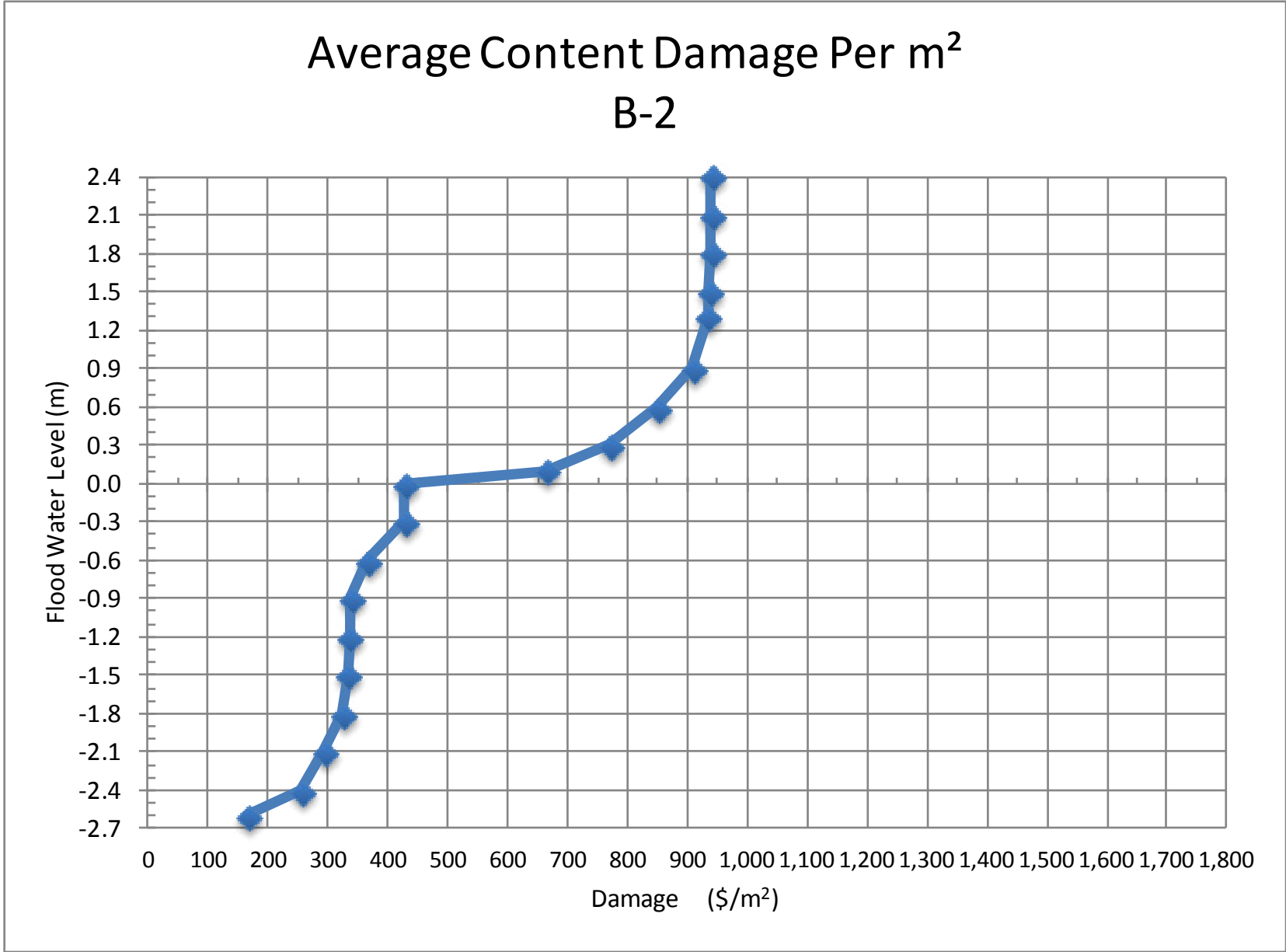
Average Content Damage Per m² A-2



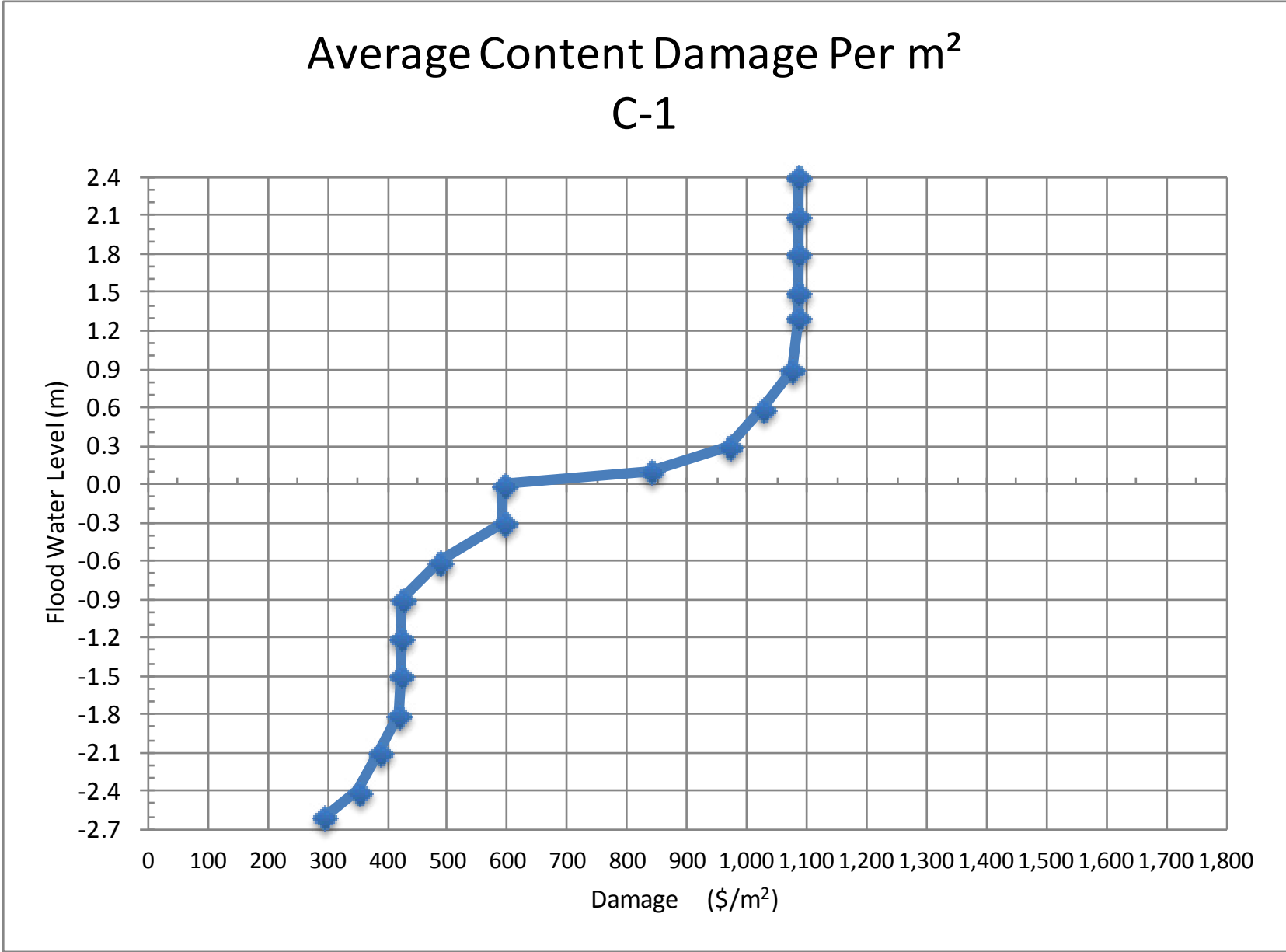
Average Content Damage Per m² B-1



Average Content Damage Per m² B-2

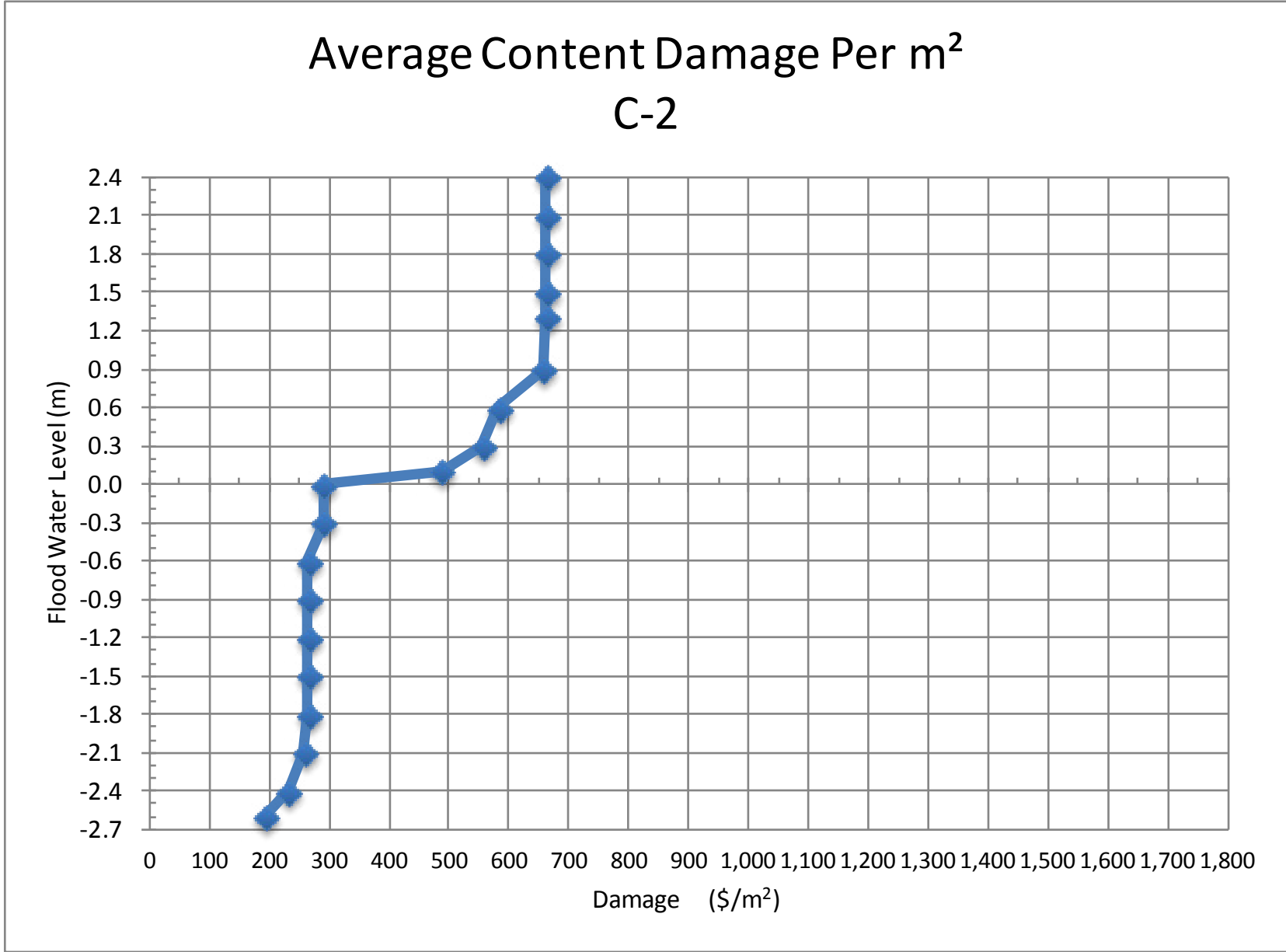


Average Content Damage Per m² C-1



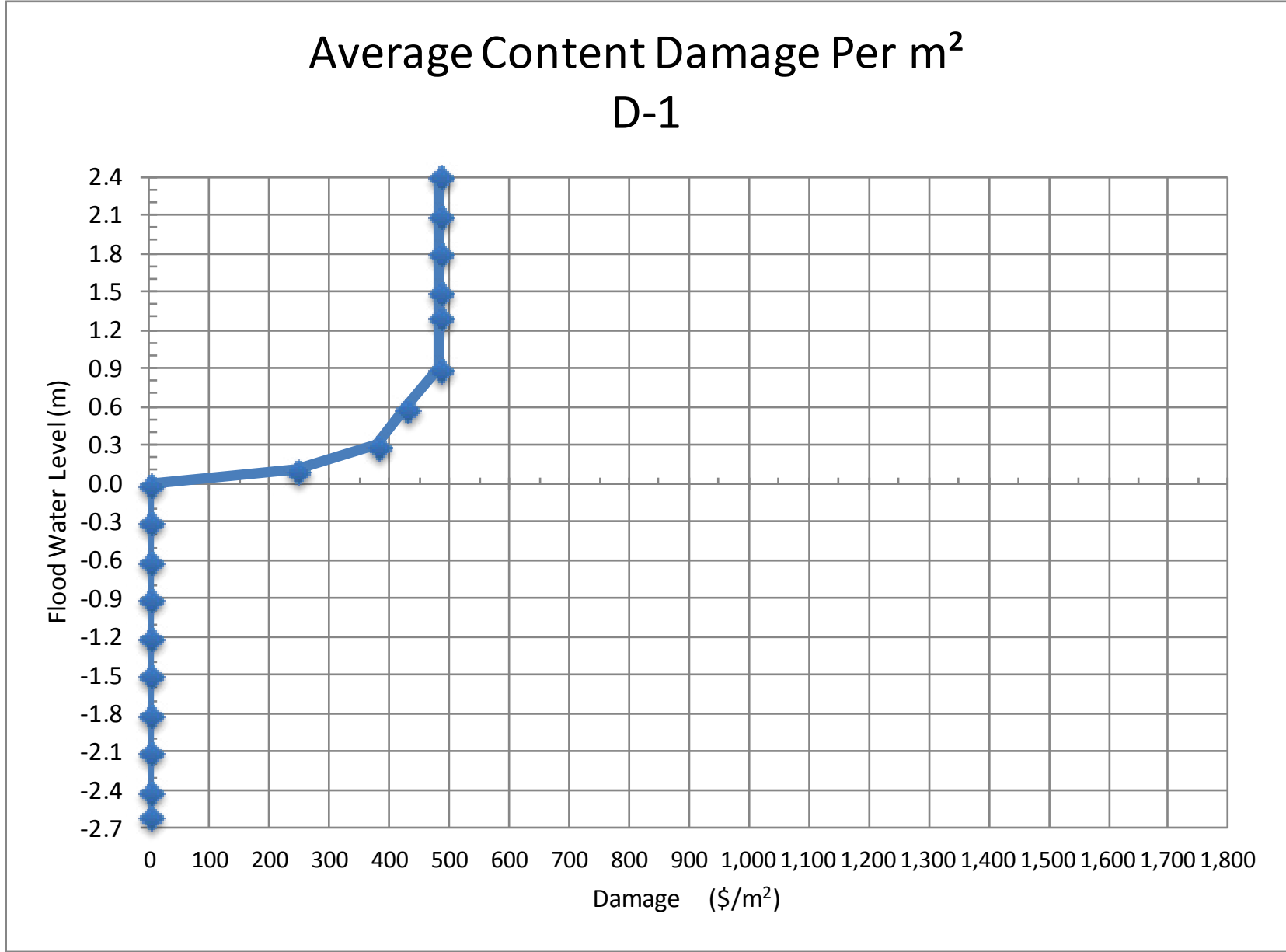
Residential Content Damage Curves

Average Content Damage Per m² C-2

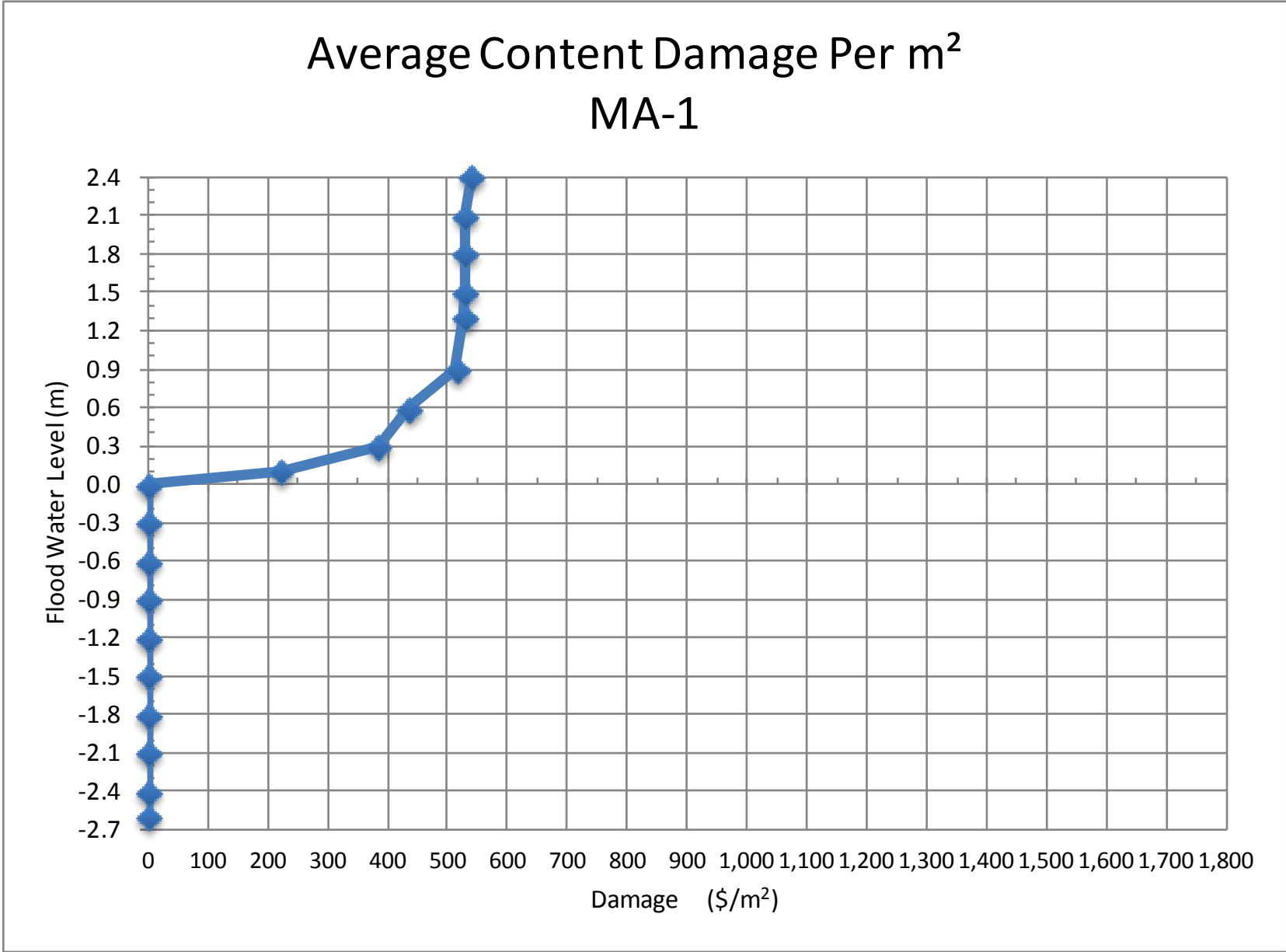


Residential Content Damage Curves

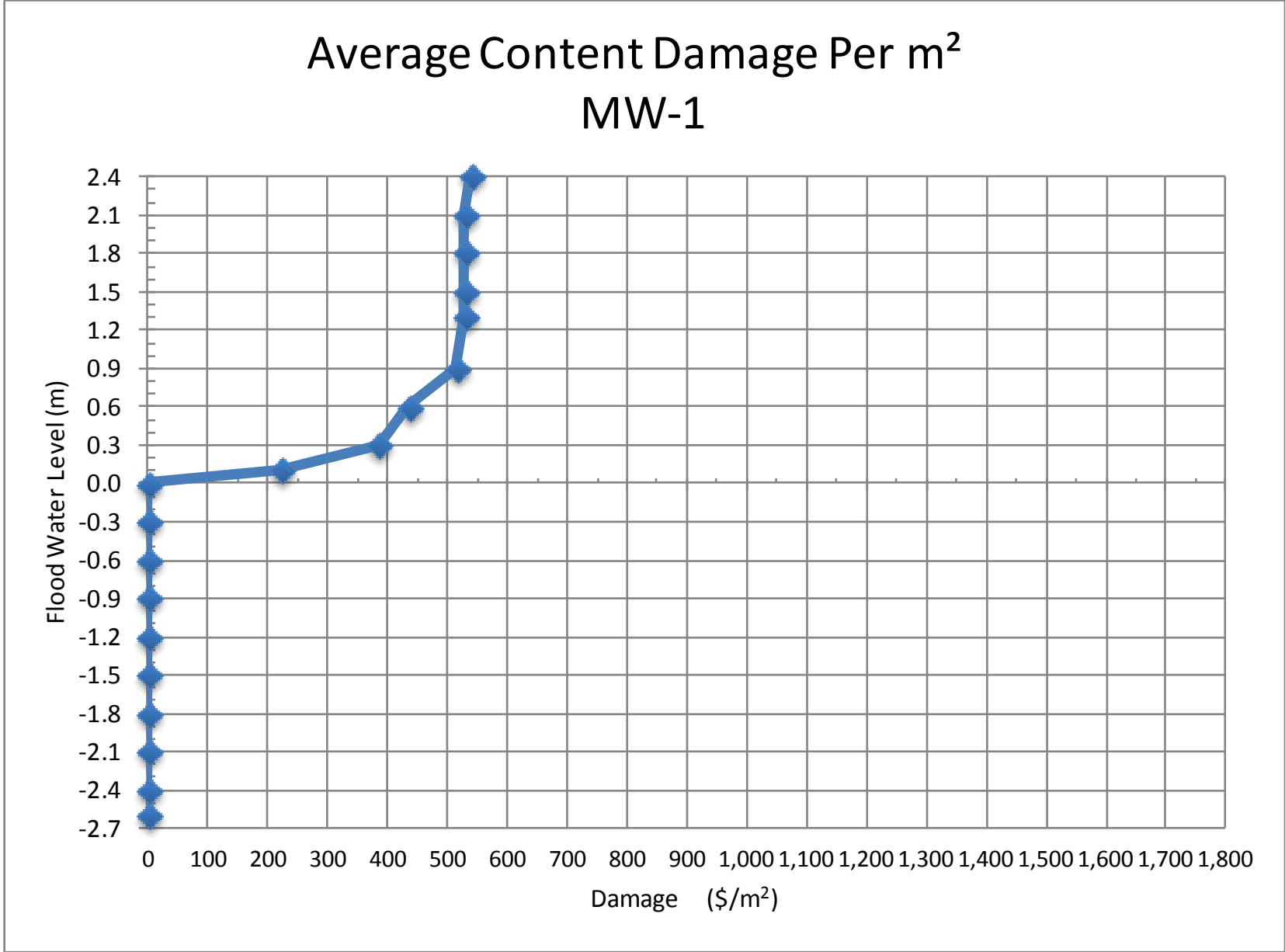
Average Content Damage Per m² D-1



Average Content Damage Per m² MA-1



Average Content Damage Per m² MW-1



Appendix C – Residential Content Damage Values

Residential Content Damage Values

Residential contents damages by interior elevation and classification, Calgary, \$/m2 floor area, 2014\$

Interior elevation		Residential classification								
		A1	A2	B1	B2	C1	C2	D1	MA1	MW1
Top of Level 0 (basement) floor	-2.7	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	-2.6	\$400	\$226	\$226	\$163	\$294	\$191	\$0	\$0	\$0
	-2.4	\$554	\$354	\$339	\$255	\$350	\$232	\$0	\$0	\$0
	-2.1	\$715	\$395	\$375	\$294	\$385	\$257	\$0	\$0	\$0
	-1.8	\$778	\$437	\$401	\$324	\$418	\$264	\$0	\$0	\$0
	-1.5	\$784	\$440	\$410	\$332	\$422	\$264	\$0	\$0	\$0
	-1.2	\$786	\$442	\$411	\$336	\$422	\$264	\$0	\$0	\$0
	-0.9	\$788	\$444	\$412	\$336	\$423	\$264	\$0	\$0	\$0
	-0.6	\$810	\$475	\$426	\$364	\$487	\$264	\$0	\$0	\$0
Level 0 (basement) ceiling	-0.3	\$836	\$523	\$504	\$427	\$592	\$290	\$0	\$0	\$0
Top of Level 1 (main) floor	0.0	\$836	\$523	\$504	\$427	\$592	\$290	\$0	\$0	\$0
	0.1	\$1,209	\$866	\$725	\$662	\$839	\$487	\$243	\$221	\$260
	0.3	\$1,460	\$1,068	\$888	\$769	\$970	\$554	\$379	\$384	\$394
	0.6	\$1,594	\$1,186	\$934	\$848	\$1,026	\$582	\$426	\$435	\$494
	0.9	\$1,645	\$1,271	\$996	\$908	\$1,074	\$657	\$481	\$514	\$565
	1.3	\$1,652	\$1,289	\$998	\$934	\$1,084	\$662	\$483	\$527	\$571
	1.5	\$1,652	\$1,290	\$998	\$935	\$1,084	\$662	\$483	\$528	\$571
	1.8	\$1,675	\$1,290	\$999	\$938	\$1,085	\$662	\$483	\$528	\$571
	2.1	\$1,675	\$1,290	\$999	\$938	\$1,085	\$662	\$483	\$528	\$571
Level 1 (main) ceiling	2.4	\$1,675	\$1,290	\$999	\$939	\$1,085	\$662	\$483	\$538	\$571

Damages include contents in attached/detached garages and outside storage; exclude contents in underground parking structures

Appendix D – Residential Structural Damage Curves

Summary of Specifications for Typical Unit Type A1 (Bungalow)

<u>Area</u>	258m ²
<u>Structure</u>	Poured concrete foundation wall, wood frame floor (Conventional or Engineered System), wall and roof assembly.
<u>Ext. Cladding</u>	Walls: Siding (prefinished), Stucco, Brick, Stone. Windows: Metal clad wood.
<u>Interior Finishes</u>	
<u>Basement</u>	Floor: Ceramic tile, carpet, prefinished hardwood. Walls: Wood or steel stud, drywall painted. Insulation: Walls (R20), 6mil poly V.B. Ceiling: T-bar, drywall stippled or textured. Doors: Wood, solid core. Stairs: Solid stringers, closed riser & plywood tread. Bathroom: 3 piece with tile finishes.
<u>Ground Floor</u>	Floor: Ceramic tile, carpet, prefinished hardwood. Walls: Drywall painted, wall vinyl. Ceiling: Drywall stippled or textured, vaulted. Doors: Wood, solid core. Insulation: Walls (R20), Ceiling (R40), 6mil poly V.B. Cabinets: Custom with island & granite / stone counters & backsplash. Bathroom: 3 & 4 piece with tile finishes.
<u>Garage</u>	Double attached wood frame walls and roof assembly on concrete slab on grade. Ext. Walls: Siding (prefinished), Stucco, Brick, Stone. Insulation: Walls (R20), Ceiling (R40), 6mil poly V.B. Int. Walls: Drywall painted. Ceiling: Drywall painted. Windows: Metal clad wood. Doors: Prefinished Metal.

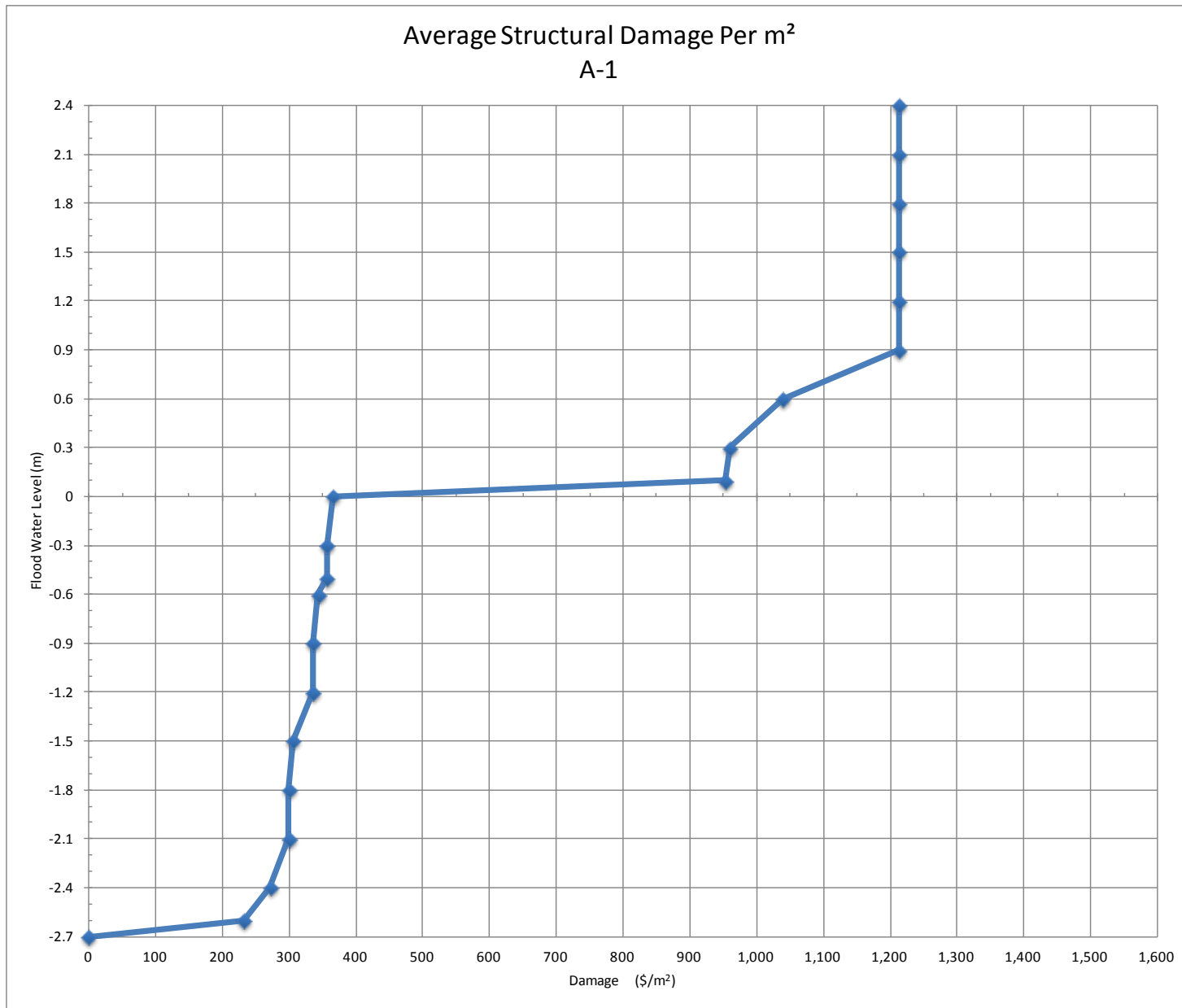
Note: Where two or more materials are shown, unit costs have been averaged.

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	• N/A					\$0	\$74,943
1.2	• Remove and replace electrical service panel.	1	unit	\$1,500	\$1,500	\$1,500	\$76,443
1.5	• Remove and replace windows.	15	window	\$500	\$7,500	\$7,500	\$83,943
1.8	• N/A						
2.1	• Remove and replace all mechanical ductwork.	1	basement	\$2,000	\$2,000	\$2,000	\$85,943
2.4	• Inspect beams and floor joists.	2	hour	\$125	\$250	\$250	\$86,193
Main Floor							
0 – 0.1	• Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring.	258	m ²	\$90	\$23,220		
	• Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting.	258	m ²	\$125	\$32,250		
	• Remove and replace baseboards.	273	linear m	\$8	\$2,184		
	• Remove and replace all drywall to walls & ceilings.	913	m ²	\$30	\$27,390		
	• Remove and replace all poly vapour barrier.	154	m ²	\$1	\$154		
	• Remove and replace all insulation.	154	m ²	\$3	\$385		
	• Remove and replace all doors & hardware.	19	door	\$700	\$13,300		
	• Remove and replace all wood casings and door jambs.	19	opening	\$125	\$2,375		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• Remove and replace all kitchen cabinets and counter tops.	1	kitchen	\$40,000	\$40,000		
	• Remove, clean and re-install bathroom toilet, sink and tub.	2.5	bathroom	\$500	\$1,250		
	• Remove and replace bathroom cabinets.	2.5	cabinet	\$1,250	\$3,125		
	• Clean and sanitize all structural components after demolition is completed.	4	hour	\$125	\$500		
	• Clean and sanitize all exterior building finishes.	4	hour	\$125	\$500		
	• Implement structural drying.	8	hour	\$75	\$600		
						\$147,233	\$147,233
0.3	• N/A					\$0	\$147,233
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	main floor	\$20,000	\$20,000		
						\$20,000	\$167,233
0.9	• Remove and replace all windows.	29	window	\$1,500	\$43,500		
						\$43,500	\$210,733
Garage							
0 – 0.1	• Clean and sanitize concrete floor.	1	hour	\$125	\$125		
	• Remove and replace all poly vapour barrier.	441	m ²	\$1	\$441		
	• Remove and replace all insulation.	441	m ²	\$3	\$1,103		
	• Remove and replace all man doors & hardware.	1	door	\$750	\$750		
	• Clean and sanitize all structural components after demolition is completed.	2	hour	\$125	\$250		
	• Clean and sanitize all exterior building finishes and overhead door.	2	hour	\$125	\$250		
	• Implement structural drying.	4	hour	\$75	\$300		
						\$3,219	\$3,219

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• N/A					\$0	\$3,219
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	garage	\$2,000	\$2,000	\$2,000	\$5,219
0.9	• Remove and replace all windows.	2	window	\$750	\$1,500	\$1,500	\$6,719
Grand Total						\$303,645	\$303,645

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type A2 (Two Storey)

<u>Area</u>	265m ²
<u>Structure</u>	Poured concrete foundation wall, wood frame floor (Conventional or Engineered System), wall and roof assembly.
<u>Ext. Cladding</u>	Walls: Siding (prefinished), Stucco, Brick, Stone. Windows: Metal clad wood.
<u>Interior Finishes</u>	
Basement	Floor: Ceramic tile, carpet, prefinished hardwood. Walls: Wood or steel stud, drywall painted. Insulation: Walls (R20), 6mil poly V.B. Ceiling: T-bar, drywall stippled or textured. Doors: Wood, solid core. Stairs: Solid stringers, closed riser & plywood tread. Bathroom: 3 piece with tile finishes.
Ground Floor	Floor: Ceramic tile, carpet, prefinished hardwood. Walls: Drywall painted, wall vinyl. Ceiling: Drywall stippled or textured, vaulted. Doors: Wood, solid core. Insulation: Walls (R20), Ceiling (R40), 6mil poly V.B. Cabinets: Custom with island & granite / stone counters & backsplash. Bathroom: 3 & 4 piece with tile finishes.
<u>Garage</u>	Double attached wood frame walls and roof assembly on concrete slab on grade. Ext. Walls: Siding (prefinished), Stucco, Brick, Stone. Insulation: Walls (R20), Ceiling (R40), 6mil poly V.B. Int. Walls: Drywall painted. Ceiling: Drywall painted. Windows: Metal clad wood. Doors: Prefinished Metal.

Note: Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

Building Type A2

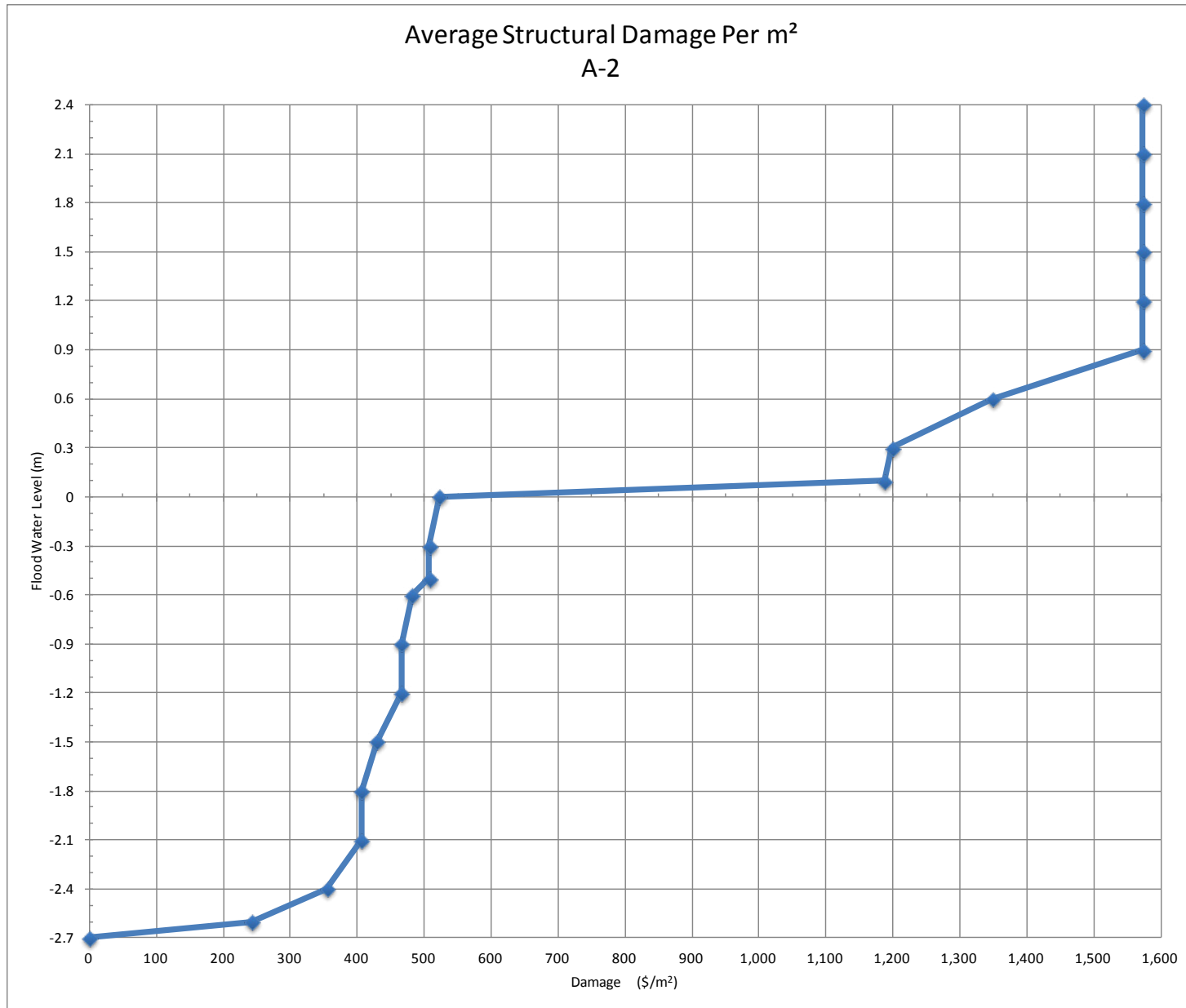
Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Basement Level							
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Visual inspection of sumps and weeping tile. Snake & clean. (10%). • Remove and replace all drywall to walls & ceilings. • Remove and replace all poly vapour barrier. • Remove and replace all insulation. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove and replace hot water heater. • Remove, clean and re-install bathroom toilet, sink and tub. • Remove and replace bathroom cabinets. • Clean & service furnace. • Clean and sanitize all structural components after demolition is completed. • Implement structural drying. 	54	m ²	\$60	\$3,240		
		79	m ²	\$110	\$8,690		
		105	linear m	\$7	\$735		
		1		\$600	\$600		
		333	m ²	\$30	\$9,990		
		111	m ²	\$1	\$111		
		111	m ²	\$3	\$278		
		9	door	\$400	\$3,600		
		9	opening	\$125	\$1,125		
		1	unit	\$1,200	\$1,200		
		1	bathroom	\$500	\$500		
		1	cabinet	\$750	\$750		
		2	hour	\$125	\$250		
		4	hour	\$125	\$500		
		8	hour	\$75	\$600		
						\$32,169	\$32,169
0.3	<ul style="list-style-type: none"> • Remove and replace furnace. 	2	unit	\$7,500	\$15,000		
						\$15,000	\$47,169
0.6	<ul style="list-style-type: none"> • Remove and replace stairs. • Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	staircase	\$2,000	\$2,000		
		1	basement	\$5,000	\$5,000		
						\$7,000	\$54,169

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	<ul style="list-style-type: none"> N/A 					\$0	\$54,169
1.2	<ul style="list-style-type: none"> Remove and replace electrical service panel. 	2	unit	\$1,500	\$3,000	\$3,000	\$57,169
1.5	<ul style="list-style-type: none"> Remove and replace windows. 	10	window	\$500	\$5,000	\$5,000	\$62,169
1.8	<ul style="list-style-type: none"> N/A 					\$0	\$62,169
2.1	<ul style="list-style-type: none"> Remove and replace all mechanical ductwork. 	1	basement	\$2,000	\$2,000	\$2,000	\$64,169
2.4	<ul style="list-style-type: none"> Inspect beams and floor joists. 	2	hour	\$125	\$250	\$250	\$64,419
Main Floor							
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring. Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting. Remove and replace baseboards. Remove and replace all drywall to walls & ceilings. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all doors & hardware. Remove and replace all wood casings and door jambs. 	0	m ²	\$90	\$0		
		133	m ²	\$125	\$16,625		
		147	linear m	\$8	\$1,176		
		484	m ²	\$30	\$14,520		
		111	m ²	\$1	\$111		
		111	m ²	\$3	\$278		
		12	door	\$700	\$8,400		
		12	opening	\$125	\$1,500		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	<ul style="list-style-type: none"> Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. Remove and replace bathroom cabinets. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes. Implement structural drying. 	1	kitchen	\$40,000	\$40,000	\$88,585	\$88,585
		2.5	bathroom	\$500	\$1,250		
		2.5	cabinet	\$1,250	\$3,125		
		4	hour	\$125	\$500		
		4	hour	\$125	\$500		
		8	hour	\$75	\$600		
0.3	• N/A					\$0	\$88,585
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	main floor	\$20,000	\$20,000	\$20,000	\$108,585
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	20	window	\$1,500	\$30,000	\$30,000	\$138,585
Garage							
0 – 0.1	<ul style="list-style-type: none"> Clean and sanitize concrete floor. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all man doors & hardware. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes and overhead door. Implement structural drying. 	1	hour	\$125	\$125	\$3,219	\$3,219
		441	m ²	\$1	\$441		
		441	m ²	\$3	\$1,103		
		1	door	\$750	\$750		
		2	hour	\$125	\$250		
		2	hour	\$125	\$250		
		4	hour	\$75	\$300		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• N/A					\$0	\$3,219
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	garage	\$2,000	\$2,000	\$2,000	\$5,219
0.9	• Remove and replace all windows.	2	window	\$750	\$1,500	\$1,500	\$6,719
Grand Total						\$209,722	\$209,722

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type B1 (Bungalow)

<u>Area</u>	151m ²
<u>Structure</u>	Poured concrete foundation wall, wood frame floor (conventional or Engineered system), wall and roof assembly.
<u>Ext. Cladding</u>	Walls: Wood siding (prefinished or painted), Vinyl, Stucco, Brick, Stone. Windows: Aluminum, wood, PVC.
<u>Interior Finishes</u>	
<u>Basement</u>	Floor: Linoleum, ceramic tile, laminate, carpet or unfinished concrete floor. Walls: Wood stud, drywall painted or unfinished. Insulation: Walls (R12), 6mil poly V.B. Ceiling: T-bar, drywall painted or stippled or unfinished. Doors: Wood, solid or hollow core. Stairs: Solid stringers, closed riser & plywood tread.
<u>Ground Floor</u>	Floor: Linoleum, ceramic tile, laminate, carpet, prefinished hardwood. Walls: Drywall painted. Ceiling: Drywall stippled. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. Cabinets: Plywood body, solid wood doors and drawers, P-Lam counter. Bathroom: Tile to ceiling above tub or fibreglass tub enclosure.
<u>Garage</u>	Double detached wood frame walls and roof assembly on concrete slab on grade. Walls: Wood siding (prefinished or painted), Vinyl, Stucco, Brick, Stone. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. or unfinished. Windows: Aluminum, wood, PVC. Doors: Prefinished Metal or painted wood.

Note: Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

Building Type B1

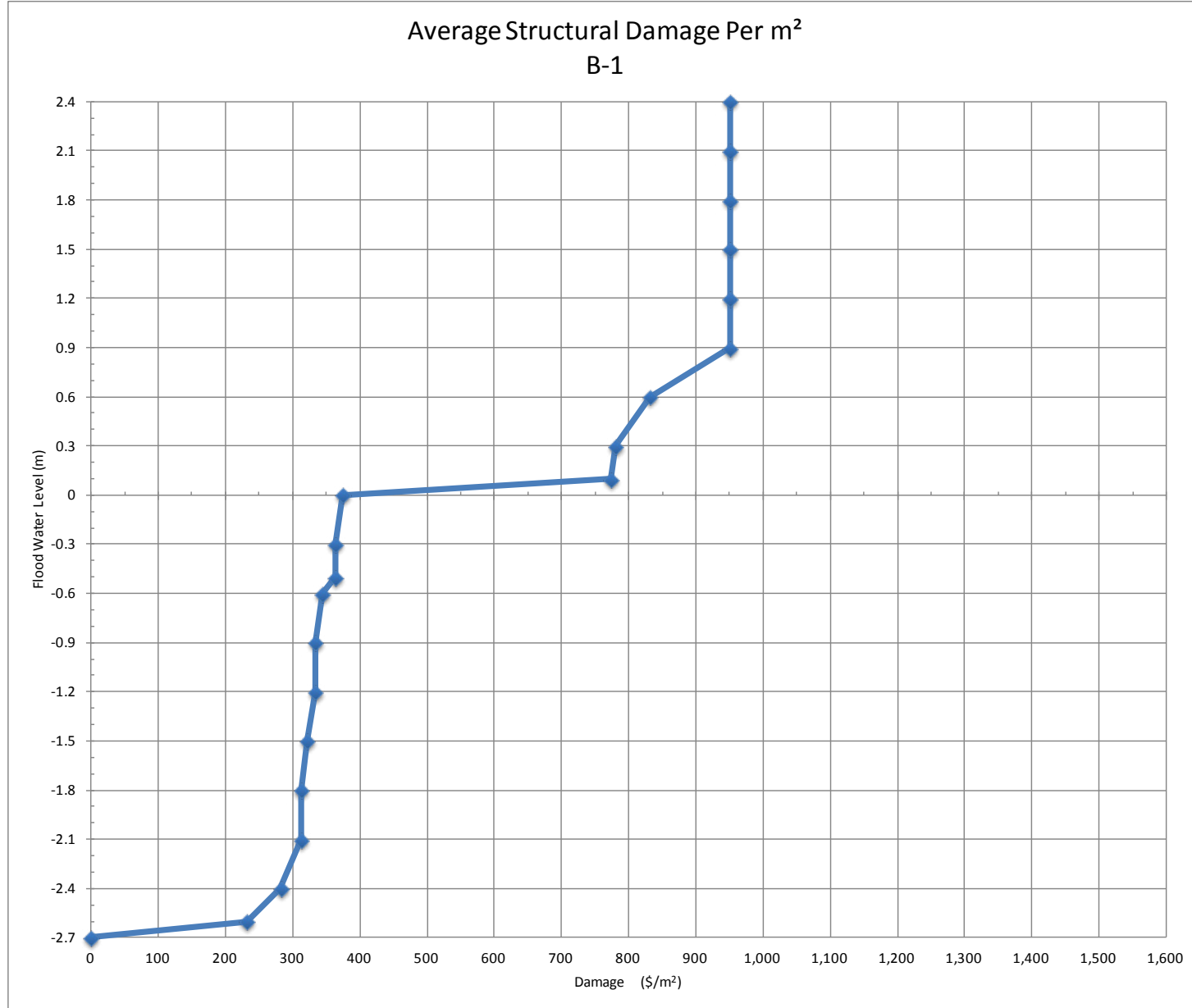
Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Basement Level							
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Visual inspection of sumps and weeping tile. Snake & clean. (10%). • Remove and replace all drywall to walls & ceilings. • Remove and replace all poly vapour barrier. • Remove and replace all insulation. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove and replace hot water heater. • Remove, clean and re-install bathroom toilet, sink and tub. • Remove and replace bathroom cabinets. • Clean & service furnace. • Clean and sanitize all structural components after demolition is completed. • Implement structural drying. 	46	m ²	\$50	\$2,300		
		105	m ²	\$100	\$10,500		
		125	linear m	\$5	\$625		
		1		\$600	\$600		
		439	m ²	\$30	\$13,170		
		118	m ²	\$1	\$118		
		118	m ²	\$3	\$295		
		9	door	\$300	\$2,700		
		9	opening	\$100	\$900		
		1	unit	\$1,200	\$1,200		
		1	bathroom	\$500	\$500		
		1	cabinet	\$500	\$500		
		2	hour	\$125	\$250		
		4	hour	\$125	\$500		
		6	hour	\$75	\$450		
						\$34,608	\$34,608
0.3	<ul style="list-style-type: none"> • Remove and replace furnace. 	1	unit	\$7,500	\$7,500		
						\$7,500	\$42,108
0.6	<ul style="list-style-type: none"> • Remove and replace stairs. • Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	staircase	\$1,500	\$1,500		
		1	basement	\$3,000	\$3,000		
						\$4,500	\$46,608

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	<ul style="list-style-type: none"> N/A 					\$0	\$46,608
1.2	<ul style="list-style-type: none"> Remove and replace electrical service panel. 	1	unit	\$1,500	\$1,500	\$1,500	\$48,108
1.5	<ul style="list-style-type: none"> Remove and replace windows. 	6	window	\$300	\$1,800	\$1,800	\$49,908
1.8	<ul style="list-style-type: none"> N/A 					\$0	\$49,908
2.1	<ul style="list-style-type: none"> Remove and replace all mechanical ductwork. 	1	basement	\$1,500	\$1,500	\$1,500	\$51,408
2.4	<ul style="list-style-type: none"> Inspect beams and floor joists. 	2	hour	\$125	\$250	\$250	\$51,658
Main Floor							
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring. 	8	m ²	\$75	\$600		
	<ul style="list-style-type: none"> Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting. 	143	m ²	\$100	\$14,300		
	<ul style="list-style-type: none"> Remove and replace baseboards. 	155	linear m	\$5	\$775		
	<ul style="list-style-type: none"> Remove and replace all drywall to walls & ceilings. 	524	m ²	\$30	\$15,720		
	<ul style="list-style-type: none"> Remove and replace all poly vapour barrier. 	118	m ²	\$1	\$118		
	<ul style="list-style-type: none"> Remove and replace all insulation. 	118	m ²	\$3	\$295		
	<ul style="list-style-type: none"> Remove and replace all doors & hardware. 	13	door	\$500	\$6,500		
	<ul style="list-style-type: none"> Remove and replace all wood casings and door jambs. 	13	opening	\$100	\$1,300		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
	<ul style="list-style-type: none"> Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. Remove and replace bathroom cabinets. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes. Implement structural drying. 	1	kitchen	\$15,000	\$15,000		
		2.5	bathroom	\$500	\$1,250		
		2.5	cabinet	\$1,000	\$2,500		
		4	hour	\$125	\$500		
		4	hour	\$125	\$500		
		6	hour	\$75	\$450		
						\$59,808	\$59,808
0.3	<ul style="list-style-type: none"> N/A 					\$0	\$59,808
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	main floor	\$7,500	\$7,500		
						\$7,500	\$67,308
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	18	window	\$1,000	\$18,000		
						\$18,000	\$85,308
Garage							
0 – 0.1	<ul style="list-style-type: none"> Clean and sanitize concrete floor. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all man doors & hardware. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes and overhead door. Implement structural drying. 	1	hour	\$125	\$125		
		349	m ²	\$1	\$349		
		349	m ²	\$3	\$873		
		1	door	\$500	\$500		
		2	hour	\$125	\$250		
		2	hour	\$125	\$250		
		4	hour	\$75	\$300		
						\$2,647	\$2,647

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• N/A					\$0	\$2,647
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	garage	\$1,500	\$1,500	\$1,500	\$4,147
0.9	• Remove and replace all windows.	2	window	\$500	\$1,000	\$1,000	\$5,147
Grand Total						\$142,113	\$142,113

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type B2 (Two Storey)

<u>Area</u>	166m ²
<u>Structure</u>	Poured concrete foundation wall, wood frame floor (conventional or Engineered system), wall and roof assembly.
<u>Ext. Cladding</u>	Walls: Wood siding (prefinished or painted), Vinyl, Stucco, Brick, Stone. Windows: Aluminum, wood, PVC.
<u>Interior Finishes</u>	
Basement	Floor: Linoleum, ceramic tile, laminate, carpet or unfinished concrete floor. Walls: Wood stud, drywall painted or unfinished. Insulation: Walls (R12), 6mil poly V.B. Ceiling: T-bar, drywall painted or stippled or unfinished. Doors: Wood, solid or hollow core. Stairs: Solid stringers, closed riser & plywood tread.
Ground Floor	Floor: Linoleum, ceramic tile, laminate, carpet, prefinished hardwood. Walls: Drywall painted. Ceiling: Drywall stippled. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. Cabinets: Plywood body, solid wood doors and drawers, P-Lam counter. Bathroom: Tile to ceiling above tub or fibreglass tub enclosure.
<u>Garage</u>	Double detached wood frame walls and roof assembly on concrete slab on grade. Walls: Wood siding (prefinished or painted), Vinyl, Stucco, Brick, Stone. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. or unfinished. Windows: Aluminum, wood, PVC. Doors: Prefinished Metal or painted wood.

Note: Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

Building Type B2

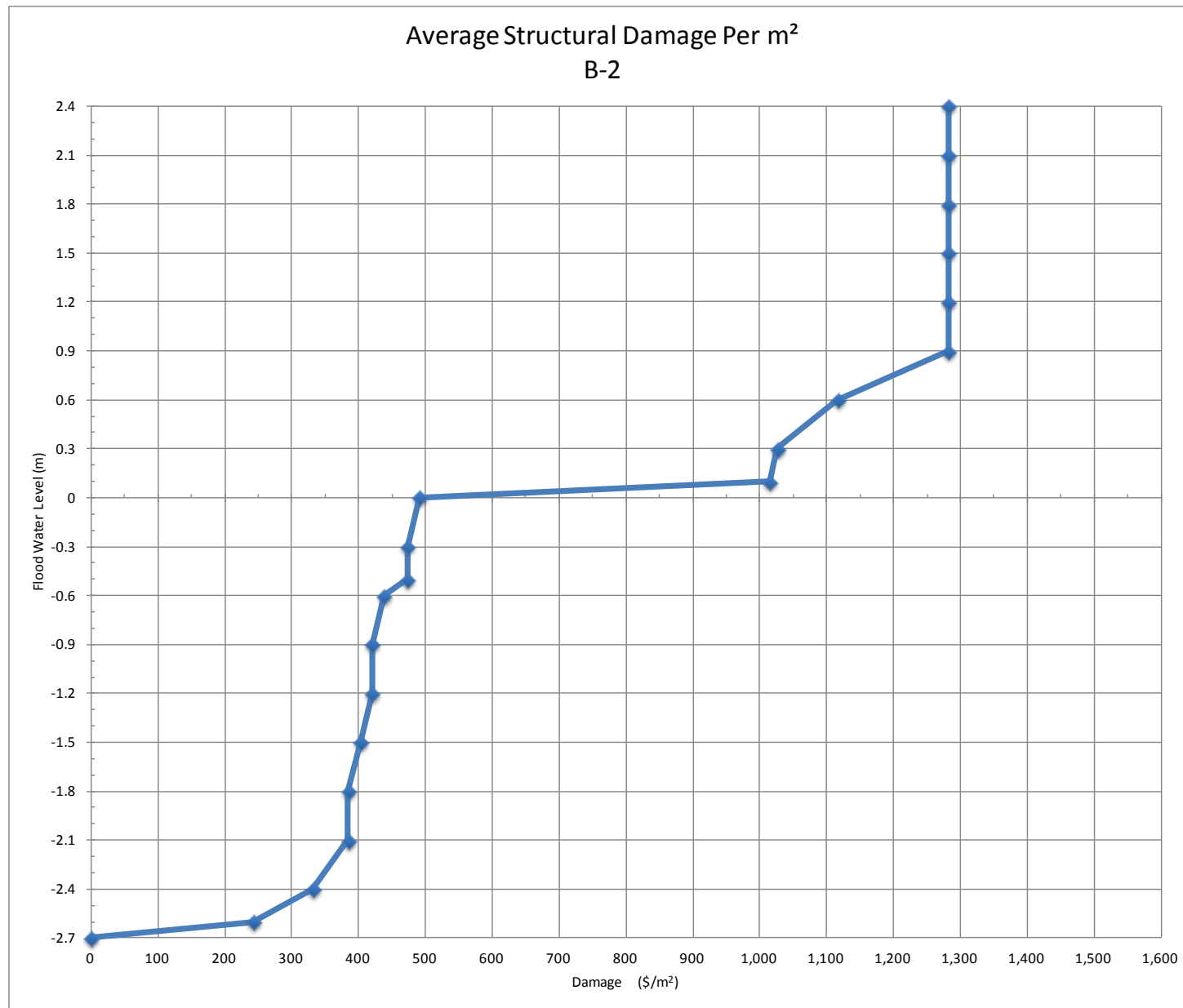
Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Basement Level							
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Visual inspection of sumps and weeping tile. Snake & clean. (10%). • Remove and replace all drywall to walls & ceilings. • Remove and replace all poly vapour barrier. • Remove and replace all insulation. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove and replace hot water heater. • Remove, clean and re-install bathroom toilet, sink and tub. • Remove and replace bathroom cabinets. • Clean & service furnace. • Clean and sanitize all structural components after demolition is completed. • Implement structural drying. 	30	m ²	\$50	\$1,500		
		53	m ²	\$100	\$5,300		
		66	linear m	\$5	\$330		
		1		\$500	\$500		
		219	m ²	\$30	\$6,570		
		87	m ²	\$1	\$87		
		87	m ²	\$3	\$218		
		6	door	\$300	\$1,800		
		6	opening	\$100	\$600		
		1	unit	\$1,200	\$1,200		
		1	bathroom	\$500	\$500		
		1	cabinet	\$500	\$500		
		2	hour	\$125	\$250		
		4	hour	\$125	\$500		
		6	hour	\$75	\$450		
						\$20,305	\$20,305
0.3	<ul style="list-style-type: none"> • Remove and replace furnace. 	1	unit	\$7,500	\$7,500		
						\$7,500	\$27,805
0.6	<ul style="list-style-type: none"> • Remove and replace stairs. • Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	staircase	\$1,500	\$1,500		
		1	basement	\$3,000	\$3,000		
						\$4,500	\$32,305

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	• N/A					\$0	\$32,305
1.2	• Remove and replace electrical service panel.	1	unit	\$1,500	\$1,500	\$1,500	\$33,805
1.5	• Remove and replace windows.	5	window	\$300	\$1,500	\$1,500	\$35,305
1.8	• N/A					\$0	\$35,305
2.1	• Remove and replace all mechanical ductwork.	1	basement	\$1,500	\$1,500	\$1,500	\$36,805
2.4	• Inspect beams and floor joists.	2	hour	\$125	\$250	\$250	\$37,055
Main Floor							
0 – 0.1	• Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring.	9	m ²	\$75	\$675		
	• Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting.	74	m ²	\$100	\$7,400		
	• Remove and replace baseboards.	106	linear m	\$5	\$530		
	• Remove and replace all drywall to walls & ceilings.	336	m ²	\$30	\$10,080		
	• Remove and replace all poly vapour barrier.	87	m ²	\$1	\$87		
	• Remove and replace all insulation.	87	m ²	\$3	\$218		
	• Remove and replace all doors & hardware.	8	door	\$500	\$4,000		
	• Remove and replace all wood casings and door jambs.	8	opening	\$100	\$800		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• Remove and replace all kitchen cabinets and counter tops.	1	kitchen	\$15,000	\$15,000		
	• Remove, clean and re-install bathroom toilet, sink and tub.	2.5	bathroom	\$500	\$1,250		
	• Remove and replace bathroom cabinets.	2.5	cabinet	\$1,000	\$2,500		
	• Clean and sanitize all structural components after demolition is completed.	4	hour	\$125	\$500		
	• Clean and sanitize all exterior building finishes.	4	hour	\$125	\$500		
	• Implement structural drying.	6	hour	\$75	\$450		
						\$43,990	\$43,990
0.3	• N/A					\$0	\$43,990
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	main floor	\$7,500	\$7,500		
						\$7,500	\$51,490
0.9	• Remove and replace all windows.	14	window	\$1,000	\$14,000		
						\$14,000	\$65,490
Garage							
0 – 0.1	• Clean and sanitize concrete floor.	1	hour	\$125	\$125		
	• Remove and replace all poly vapour barrier.	349	m ²	\$1	\$349		
	• Remove and replace all insulation.	349	m ²	\$3	\$873		
	• Remove and replace all man doors & hardware.	1	door	\$500	\$500		
	• Clean and sanitize all structural components after demolition is completed.	2	hour	\$125	\$250		
	• Clean and sanitize all exterior building finishes and overhead door.	2	hour	\$125	\$250		
	• Implement structural drying.	4	hour	\$75	\$300		
						\$2,647	\$2,647

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• N/A					\$0	\$2,647
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	garage	\$1,500	\$1,500	\$1,500	\$4,147
0.9	• Remove and replace all windows.	2	window	\$500	\$1,000	\$1,000	\$5,147
Grand Total						\$107,691	\$107,691

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type C1 (Bungalow)

<u>Area</u>	84m ²
<u>Structure</u>	Poured concrete foundation wall, wood frame floor wall and roof assembly.
<u>Ext. Cladding</u>	Walls: Wood siding painted, Vinyl, Stucco. Windows: Wood.
<u>Interior Finishes</u>	
Basement	Floor: Linoleum, carpet or unfinished. Walls: Wood stud, drywall painted. Ceiling: T-bar, drywall painted or unfinished. Doors: Wood, hollow core. Stairs: Solid stringers, closed riser & plywood tread.
Ground Floor	Floor: Linoleum, laminate, carpet, hardwood. Walls: Drywall painted. Ceiling: Drywall stippled. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. Cabinets: Plywood body, solid wood doors and drawers, P-Lam counters. Bathroom: Tile to 1.2m above tub.
<u>Garage</u>	Single detached wood frame walls and roof assembly on concrete slab on grade. Walls: Wood siding painted, Vinyl, Stucco. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. or unfinished. Windows: Wood. Doors: Painted wood.

Note: Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

Building Type C1

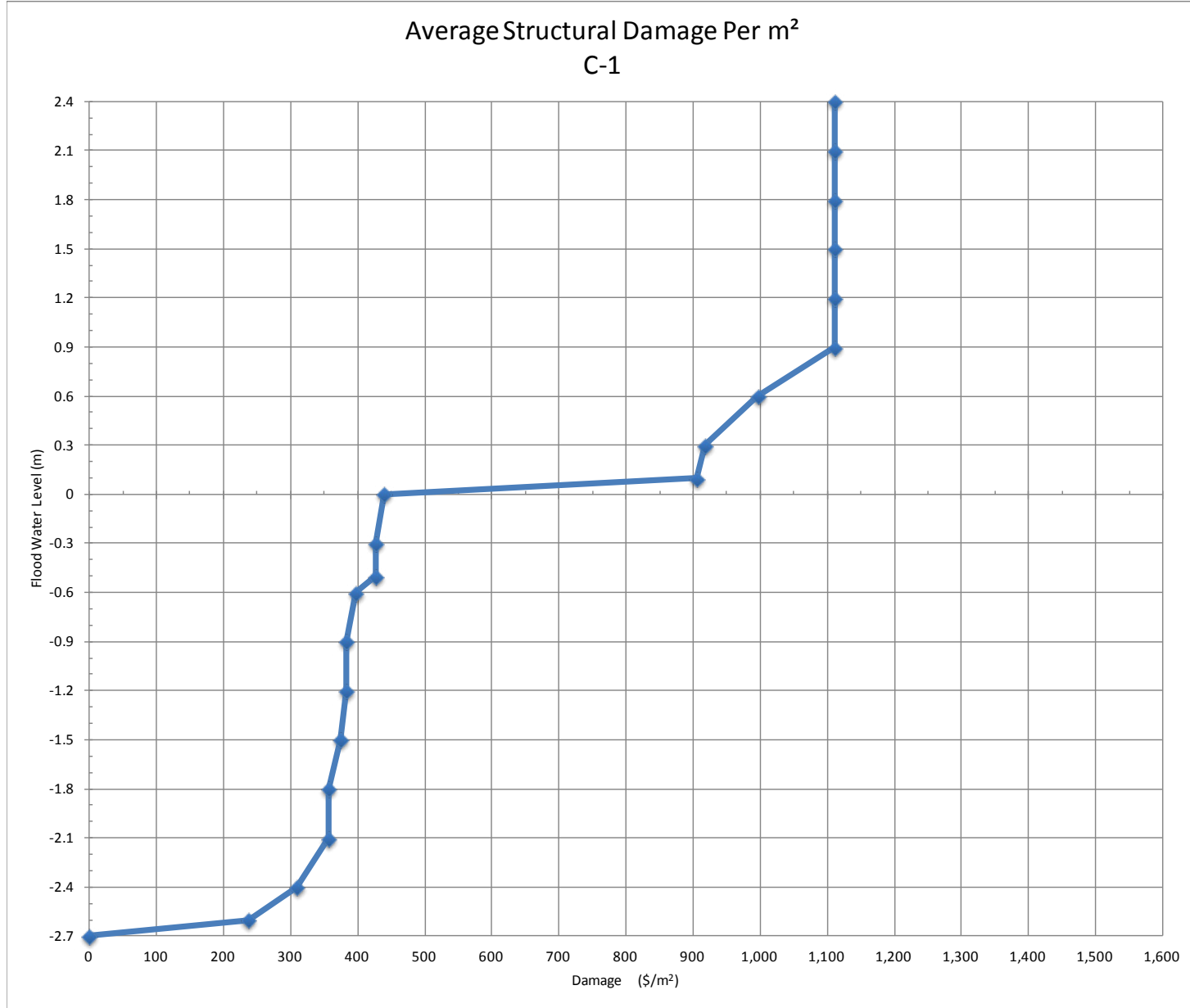
Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Basement Level							
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Visual inspection of sumps and weeping tile. Snake & clean. (10%). • Remove and replace all drywall to walls & ceilings. • Remove and replace all poly vapour barrier. • Remove and replace all insulation. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove and replace hot water heater. • Remove, clean and re-install bathroom toilet, sink and tub. • Remove and replace bathroom cabinets. • Clean & service furnace. • Clean and sanitize all structural components after demolition is completed. • Implement structural drying. 	37	m ²	\$45	\$1,665		
		47	m ²	\$90	\$4,230		
		71	linear m	\$4	\$284		
		1		\$500	\$500		
		232	m ²	\$30	\$6,960		
		88	m ²	\$1	\$88		
		88	m ²	\$3	\$220		
		8	door	\$250	\$2,000		
		8	opening	\$90	\$720		
		1	unit	\$1,200	\$1,200		
		1	bathroom	\$500	\$500		
		1	cabinet	\$350	\$350		
		2	hour	\$125	\$250		
		4	hour	\$125	\$500		
		4	hour	\$75	\$300		
						\$19,767	\$19,767
0.3	<ul style="list-style-type: none"> • Remove and replace furnace. 	1	unit	\$6,000	\$6,000		
						\$6,000	\$25,767
0.6	<ul style="list-style-type: none"> • Remove and replace stairs. • Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	staircase	\$1,500	\$1,500		
		1	basement	\$2,500	\$2,500		
						\$4,000	\$29,767

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	<ul style="list-style-type: none"> N/A 					\$0	\$29,767
1.2	<ul style="list-style-type: none"> Remove and replace electrical service panel. 	1	unit	\$1,500	\$1,500	\$1,500	\$31,267
1.5	<ul style="list-style-type: none"> Remove and replace windows. 	3	window	\$250	\$750	\$750	\$32,017
1.8	<ul style="list-style-type: none"> N/A 					\$0	\$32,017
2.1	<ul style="list-style-type: none"> Remove and replace all mechanical ductwork. 	1	basement	\$1,200	\$1,200	\$1,200	\$33,217
2.4	<ul style="list-style-type: none"> Inspect beams and floor joists. 	2	hour	\$125	\$250	\$250	\$33,467
Main Floor							
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring. 	21	m ²	\$65	\$1,365		
	<ul style="list-style-type: none"> Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting. 	62	m ²	\$90	\$5,580		
	<ul style="list-style-type: none"> Remove and replace baseboards. 	102	linear m	\$4	\$408		
	<ul style="list-style-type: none"> Remove and replace all drywall to walls & ceilings. 	327	m ²	\$30	\$9,810		
	<ul style="list-style-type: none"> Remove and replace all poly vapour barrier. 	88	m ²	\$1	\$88		
	<ul style="list-style-type: none"> Remove and replace all insulation. 	88	m ²	\$3	\$220		
	<ul style="list-style-type: none"> Remove and replace all doors & hardware. 	9	door	\$350	\$3,150		
	<ul style="list-style-type: none"> Remove and replace all wood casings and door jambs. 	9	opening	\$90	\$810		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
	<ul style="list-style-type: none"> Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. Remove and replace bathroom cabinets. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes. Implement structural drying. 	1	kitchen	\$15,000	\$15,000		
		1	bathroom	\$500	\$500		
		1	cabinet	\$750	\$750		
		4	hour	\$125	\$500		
		4	hour	\$125	\$500		
		4	hour	\$75	\$300		
						\$38,981	\$38,981
0.3	<ul style="list-style-type: none"> N/A 					\$0	\$38,981
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	main floor	\$6,500	\$6,500		
						\$6,500	\$45,481
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	12	window	\$800	\$9,600		
						\$9,600	\$55,081
Garage							\$88,548
0 – 0.1	<ul style="list-style-type: none"> Clean and sanitize concrete floor. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all man doors & hardware. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes and overhead door. Implement structural drying. 	1	hour	\$125	\$125		
		220	m ²	\$1	\$220		
		220	m ²	\$3	\$550		
		1	door	\$500	\$500		
		2	hour	\$125	\$250		
		2	hour	\$125	\$250		
		4	hour	\$75	\$300		
						\$2,195	\$2,195
0.3	<ul style="list-style-type: none"> N/A 					\$0	\$2,195

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	garage	\$1,000	\$1,000	\$1,000	\$3,195
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	2	window	\$500	\$1,000	\$1,000	\$4,195
Grand Total						\$92,743	\$92,743

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type C2 (Two Storey)

<u>Area</u>	99m ²
<u>Structure</u>	Poured concrete foundation wall, wood frame floor wall and roof assembly.
<u>Ext. Cladding</u>	Walls: Wood siding painted, Vinyl, Stucco. Windows: Wood.
<u>Interior Finishes</u>	
Basement	Floor: Linoleum, carpet or unfinished. Walls: Wood stud, drywall painted. Ceiling: T-bar, drywall painted or unfinished. Doors: Wood, hollow core. Stairs: Solid stringers, closed riser & plywood tread.
Ground Floor	Floor: Linoleum, laminate, carpet, hardwood. Walls: Drywall painted. Ceiling: Drywall stippled. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. Cabinets: Plywood body, solid wood doors and drawers, P-Lam counters. Bathroom: Tile to 1.2m above tub.
<u>Garage</u>	Single detached wood frame walls and roof assembly on concrete slab on grade. Walls: Wood siding painted, Vinyl, Stucco. Insulation: Walls (R12), Ceiling (R20), 6mil poly V.B. or unfinished. Windows: Wood. Doors: Painted wood.

Note: Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

Building Type C2

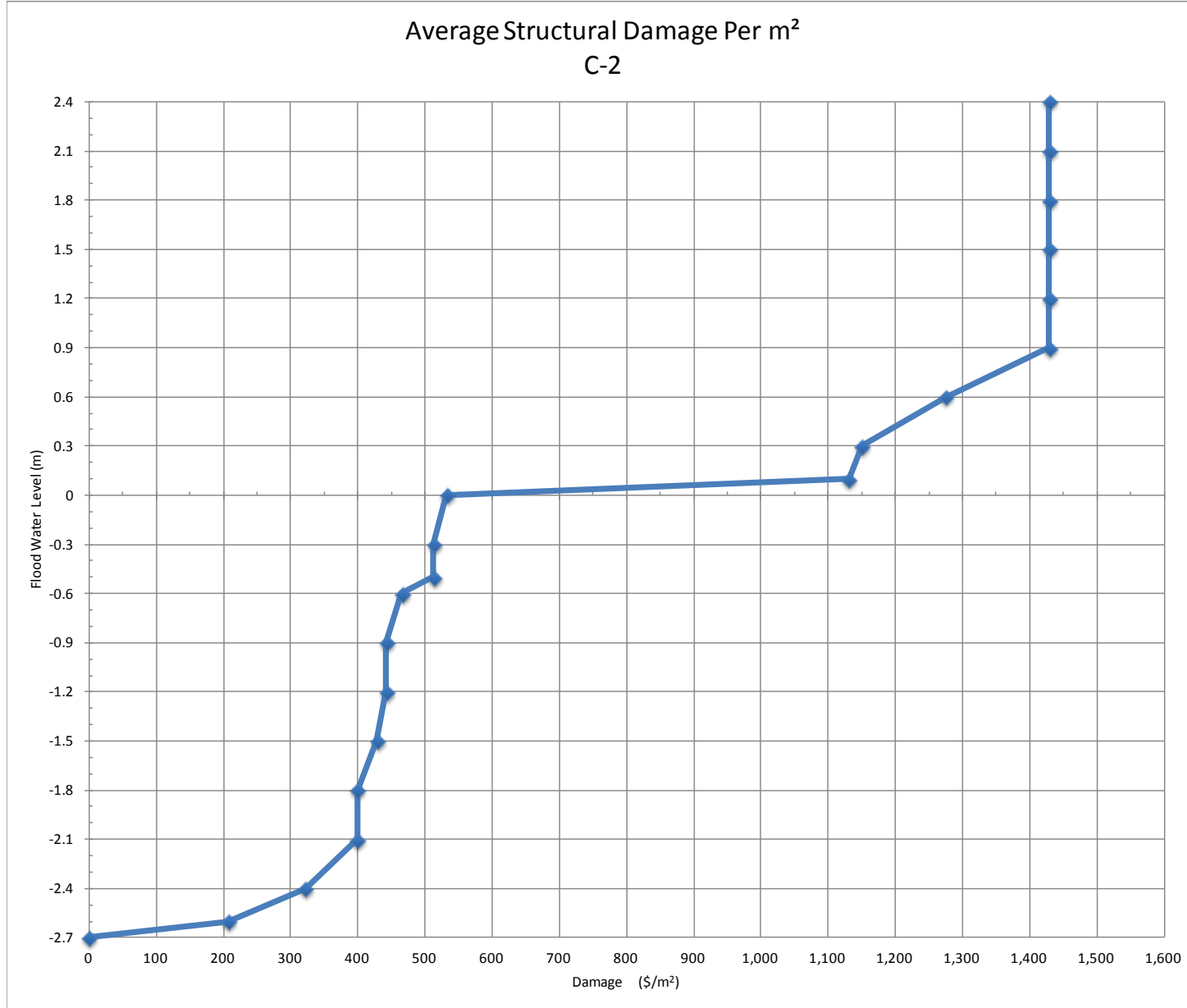
Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Basement Level							
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Visual inspection of sumps and weeping tile. Snake & clean. (10%). • Remove and replace all drywall to walls & ceilings. • Remove and replace all poly vapour barrier. • Remove and replace all insulation. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove and replace hot water heater. • Remove, clean and re-install bathroom toilet, sink and tub. • Remove and replace bathroom cabinets. • Clean & service furnace. • Clean and sanitize all structural components after demolition is completed. • Implement structural drying. 	25	m ²	\$45	\$1,125		
		24	m ²	\$90	\$2,160		
		26	linear m	\$4	\$104		
		1		\$400	\$400		
		87	m ²	\$30	\$2,610		
		67	m ²	\$1	\$67		
		67	m ²	\$3	\$168		
		3	door	\$250	\$750		
		3	opening	\$90	\$270		
		1	unit	\$1,200	\$1,200		
		1	bathroom	\$500	\$500		
		1	cabinet	\$350	\$350		
		2	hour	\$125	\$250		
		4	hour	\$125	\$500		
		4	hour	\$75	\$300		
						\$10,754	\$10,754
0.3	<ul style="list-style-type: none"> • Remove and replace furnace. 	1	unit	\$6,000	\$6,000		
						\$6,000	\$16,754
0.6	<ul style="list-style-type: none"> • Remove and replace stairs. • Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	staircase	\$1,500	\$1,500		
		1	basement	\$2,500	\$2,500		
						\$4,000	\$20,754

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	<ul style="list-style-type: none"> N/A 					\$0	\$20,754
1.2	<ul style="list-style-type: none"> Remove and replace electrical service panel. 	1	unit	\$1,500	\$1,500	\$1,500	\$22,254
1.5	<ul style="list-style-type: none"> Remove and replace windows. 	3	window	\$250	\$750	\$750	\$23,004
1.8	<ul style="list-style-type: none"> N/A 					\$0	\$23,004
2.1	<ul style="list-style-type: none"> Remove and replace all mechanical ductwork. 	1	basement	\$1,200	\$1,200	\$1,200	\$24,204
2.4	<ul style="list-style-type: none"> Inspect beams and floor joists. 	2	hour	\$125	\$250	\$250	\$24,454
Main Floor							
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring. 	12	m ²	\$65	\$780		
	<ul style="list-style-type: none"> Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting. 	37	m ²	\$90	\$3,330		
	<ul style="list-style-type: none"> Remove and replace baseboards. 	68	linear m	\$4	\$272		
	<ul style="list-style-type: none"> Remove and replace all drywall to walls & ceilings. 	212	m ²	\$30	\$6,360		
	<ul style="list-style-type: none"> Remove and replace all poly vapour barrier. 	67	m ²	\$1	\$67		
	<ul style="list-style-type: none"> Remove and replace all insulation. 	67	m ²	\$3	\$168		
	<ul style="list-style-type: none"> Remove and replace all doors & hardware. 	6	door	\$350	\$2,100		
	<ul style="list-style-type: none"> Remove and replace all wood casings and door jambs. 	6	opening	\$90	\$540		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
	<ul style="list-style-type: none"> Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. Remove and replace bathroom cabinets. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes. Implement structural drying. 	1	kitchen	\$15,000	\$15,000		
		1	bathroom	\$500	\$500		
		1	cabinet	\$750	\$750		
		4	hour	\$125	\$500		
		4	hour	\$125	\$500		
		4	hour	\$75	\$300		
						\$31,167	\$31,167
0.3	<ul style="list-style-type: none"> N/A 					\$0	\$31,167
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	main floor	\$6,500	\$6,500		
						\$6,500	\$37,667
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	10	window	\$800	\$8,000		
						\$8,000	\$45,667
Garage							\$70,120
0 – 0.1	<ul style="list-style-type: none"> Clean and sanitize concrete floor. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all man doors & hardware. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes and overhead door. Implement structural drying. 	1	hour	\$125	\$125		
		220	m ²	\$1	\$220		
		220	m ²	\$3	\$550		
		1	door	\$500	\$500		
		2	hour	\$125	\$250		
		2	hour	\$125	\$250		
		4	hour	\$75	\$300		
						\$2,195	\$2,195

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.3	• N/A					\$0	\$2,195
0.6	• Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel.	1	garage	\$1,000	\$1,000	\$1,000	\$3,195
0.9	• Remove and replace all windows.	2	window	\$500	\$1,000	\$1,000	\$4,195
Grand Total						\$74,315	\$74,315

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type D (Mobile Home)

Area 128m²

Foundation Wood cribbing on grade w/ metal or wood skirting.

Structure Wood frame walls and roof assembly.

Ext. Cladding Walls: Aluminum or vinyl siding, plywood trim.

Windows: Aluminum sliders in wood frame.

Interior Finishes

Floor: Linoleum, carpet.

Walls: Drywall painted.

Ceiling: Drywall stippled.

Insulation: Walls (R12), Ceiling (R20), Floor (R20), 2mil poly V.B.

Cabinets: Plywood body, solid wood doors and drawers, P-Lam counters.

Bathroom: PVC in tub alcove.

Note: Where two or more materials are shown, unit costs have been averaged.

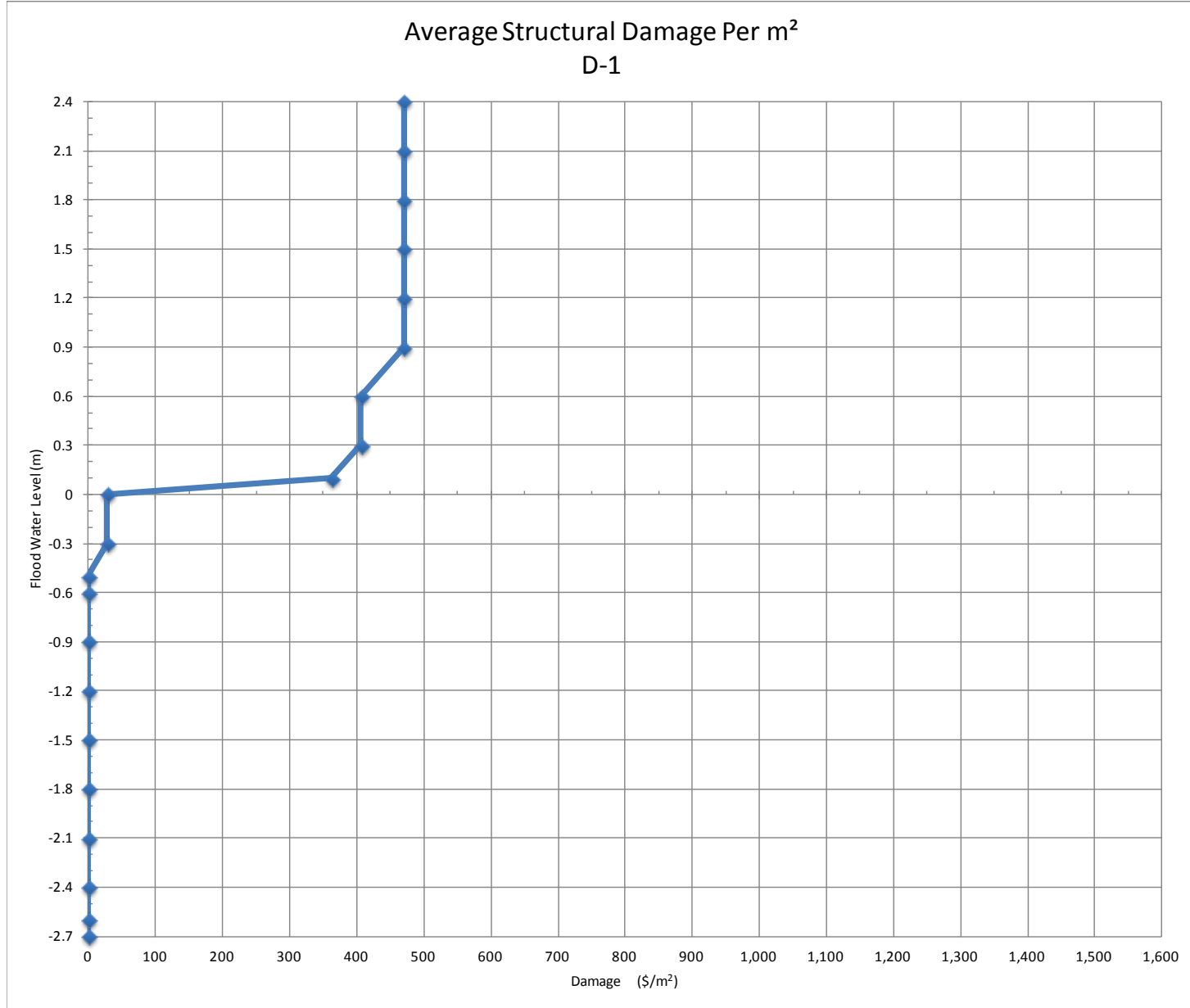
Flood Damage Study

Building Type D

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Crawl Space							
0 – 0.1	<ul style="list-style-type: none"> Remove and replace existing perimeter skirting with new skirting. Remove and replace under floor poly vapour barrier. Remove and replace under floor insulation. Remove and replace under floor ductwork. Clean and sanitize all under floor components after demolition is completed. Implement structural drying. Inspect all structure and floor joists. 	52	m ²	\$15	\$780		
		128	m ²	\$1	\$128		
		128	m ²	\$3	\$320		
		1		\$1,200	\$1,200		
		4	hour	\$125	\$500		
		4	hour	\$75	\$300		
		2	hour	\$125	\$250		
						\$3,478	\$3,478
Main Floor							
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and sand subfloor sheathing. Install new flooring. Remove existing carpet. Clean and sand subfloor sheathing. Install new carpeting. Remove and replace baseboards. Remove and replace all drywall to walls & ceilings. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all doors & hardware. Remove and replace all wood casings and door jambs. Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. Remove and replace bathroom cabinets. Clean and sanitize all structural components after demolition is completed. 	78	m ²	\$60	\$4,680		
		51	m ²	\$80	\$4,080		
		161	linear m	\$3	\$483		
		516	m ²	\$30	\$15,480		
		109	m ²	\$1	\$109		
		109	m ²	\$3	\$273		
		11	door	\$300	\$3,300		
		11	opening	\$80	\$880		
		1	kitchen	\$10,000	\$10,000		
		2	bathroom	\$500	\$1,000		
		2	cabinet	\$650	\$1,300		
		4	hour	\$125	\$500		

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
	<ul style="list-style-type: none"> Clean and sanitize all exterior building finishes. Implement structural drying. 	4	hour	\$125	\$500	\$42,885	\$42,885
		4	hour	\$75	\$300		
0.3	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. 	1	main floor	\$5,500	\$5,500	\$5,500	\$48,385
0.6	<ul style="list-style-type: none"> N/A 					\$0	\$48,385
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	11	window	\$750	\$8,250	\$8,250	\$56,635
Grand Total						\$60,113	\$60,113

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type MA (Apartment Tower)

Structure Poured concrete, foundation, parkade, columns and horizontal floor slabs including stairs.

Ext. Cladding Walls: Steel studs, drywall sheathing and brick veneer.

Windows: Aluminum sliders in wood frame.

Interior Finishes

Parkade: Floor: Concrete painted or unfinished.

Walls: Poured concrete or masonry – painted or unfinished.

Doors: Hollow metal & pressed steel frames.

Ceiling: Concrete painted.

Ground Floor: Floor: Linoleum, carpet, laminate.

Walls: Drywall painted.

Doors: Solid / hollow core wood.

Ceiling: Drywall stippled.

Insulation: Walls (R20), Ceiling (R40), 6mil poly V.B.

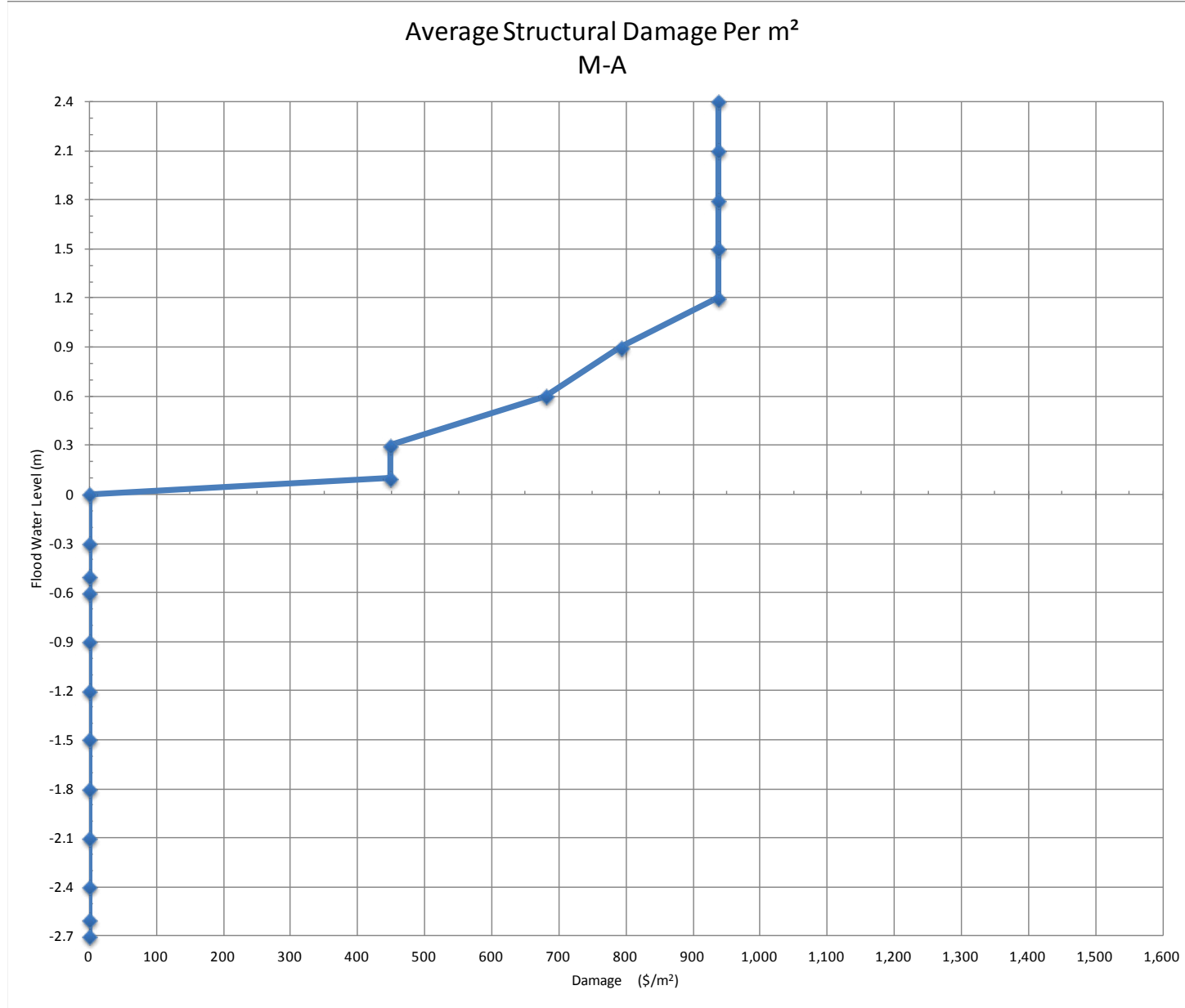
Cabinets: Plywood body, solid wood doors and drawers, P-Lam counters.

Bathroom: Tile to ceiling above tub.

Note: -Where two or more materials are shown, unit costs have been averaged.
-Damage costs compiled reflect damages for one unit plus a percentage of related common areas.
To find total building damage costs, multiply unit cost time's number of units.

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. Replace elevator doors 	1	main floor	\$6,500	\$6,500		
		2	each	\$7,500	\$15,000		
						\$21,500	\$63,267
0.9	<ul style="list-style-type: none"> Remove and replace all windows. Replace security DVR 	5	window	\$800	\$4,000		
		1	each	\$6,500	\$6,500		
						\$10,500	\$73,767
1.2	Replace fire panel Replace intercom	1	each	\$7,500	\$7,500		
		1	each	\$7,500	\$6,000		
						\$13,500	\$87,267
Corridors, Amenity Areas, Lobby, Office, Stairs & Service Rooms:	<ul style="list-style-type: none"> Average level of finish. Add 30% to level of damage in typical unit. As denoted by *. 						
Grand Total						\$87,267	\$87,267

Residential Structural Damage Curves



Summary of Specifications for Typical Unit Type MW (Walk-Up Apartments)

Structure Poured concrete foundation wall, parkade, concrete slab on grade, wood frame walls, floor and roof assembly.

Ext. Cladding Walls: Wood siding, painted / aluminum siding, prefinished / brick veneer.

Windows: Aluminum sliders in wood frame.

Interior Finishes

Parkade: Floor: Concrete painted or unfinished.

Walls: Poured concrete or masonry – painted or unfinished.

Doors: Hollow metal & pressed steel frames.

Ceiling: Concrete painted.

Ground Floor: Floor: Linoleum, carpet, laminate.

Walls: Drywall painted.

Doors: Solid / hollow core wood.

Ceiling: Drywall stippled.

Insulation: Walls (R20), Ceiling (R40), 6mil poly V.B.

Cabinets: Plywood body, solid wood doors and drawers, P-Lam counters.

Bathroom: Tile to ceiling above tub.

Note: -Where two or more materials are shown, unit costs have been averaged.
-Damage costs compiled reflect damages for one unit plus a percentage of related common areas.
To find total building damage costs, multiply unit cost time's number of units.

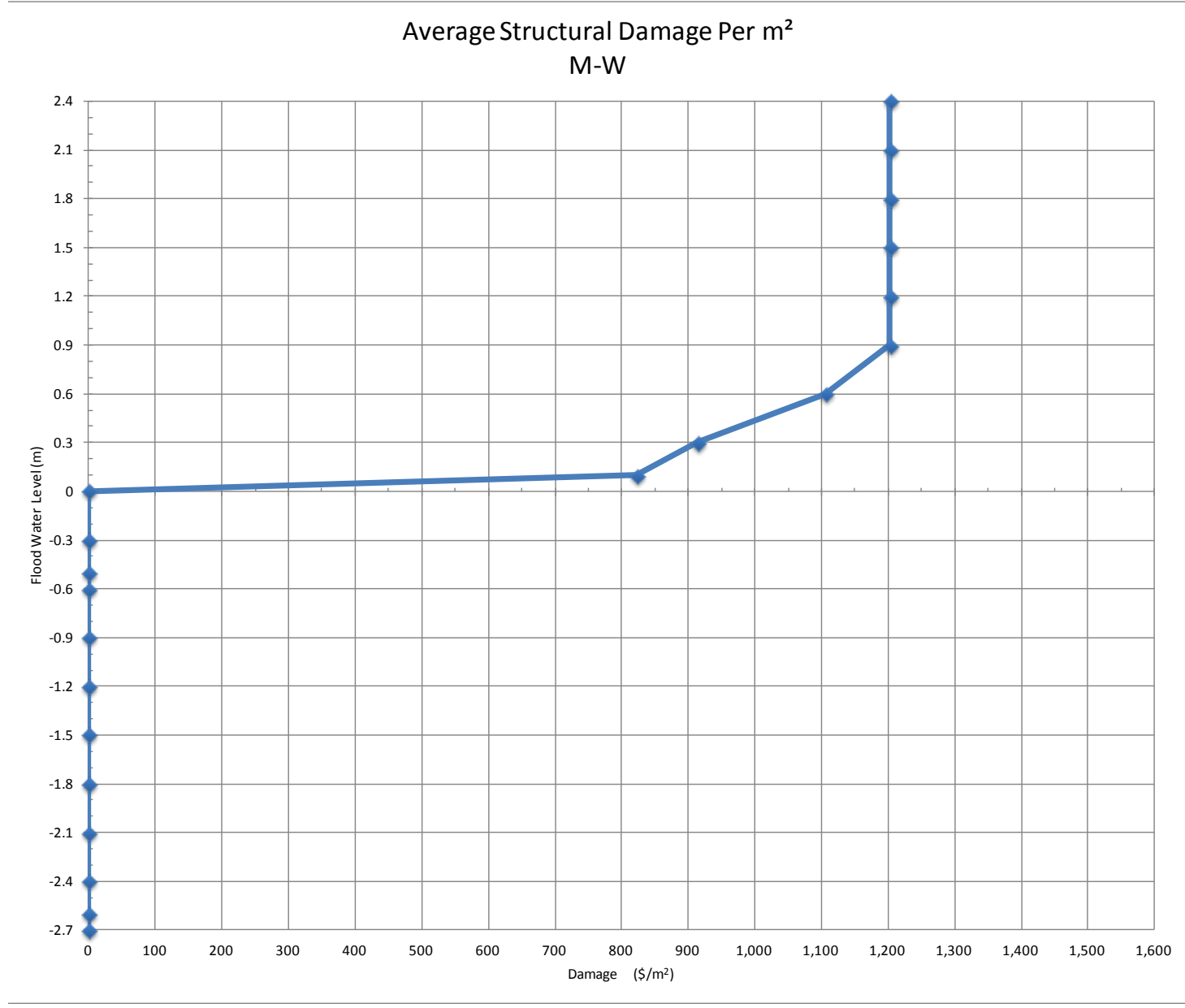
Flood Damage Study

Building Type MW

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Parkade	<ul style="list-style-type: none"> Restoration based on floor area. 		m ²				
Main Level							
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and prepare slab. Install new flooring. Remove existing carpet. Clean and prepare slab. Install new carpeting. Remove and replace baseboards. Remove and replace all drywall to walls & ceilings. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all doors & hardware. Remove and replace all wood casings and door jambs. Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. Remove and replace bathroom cabinets. Check and clean heating units. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes. Implement structural drying. 	32	m ²	\$65	\$2,080		
		100	m ²	\$90	\$9,000		
		190	linear m	\$4	\$760		
		587	m ²	\$30	\$17,610		
		55	m ²	\$1	\$55		
		55	m ²	\$3	\$138		
		11	door	\$350	\$3,850		
		11	opening	\$90	\$990		
		1	kitchen	\$15,000	\$15,000		
		2	bathroom	\$500	\$1,000		
		2	cabinet	\$750	\$1,500		
		3	hour	\$50	\$150		
		4	hour	\$125	\$500		
		4	hour	\$125	\$500		
		8	hour	\$75	\$600		
						\$53,733	\$53,733
0.3	<ul style="list-style-type: none"> Mechanical 	0.5	each	\$12,000	\$6,000		
						\$6,000	\$59,733

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.6	<ul style="list-style-type: none"> Remove and replace electrical outlets, switches, light fixtures and wiring back to the service panel. Mechanical 	1	main floor	\$6,500	\$6,500	\$12,500	\$72,233
		0.5	each	\$12,000	\$6,000		
0.9	<ul style="list-style-type: none"> Remove and replace all windows. 	8	window	\$800	\$6,400	\$6,400	\$78,633
Corridors, Amenity Areas, Lobby, Office, Stairs & Service Rooms:	<ul style="list-style-type: none"> Average level of finish. Add 30% to level of damage in typical unit. As denoted by *. 						
Grand Total						\$78,633	

Residential Structural Damage Curves



Appendix E – Residential Structural Damage Values

Residential Structural Damage Values

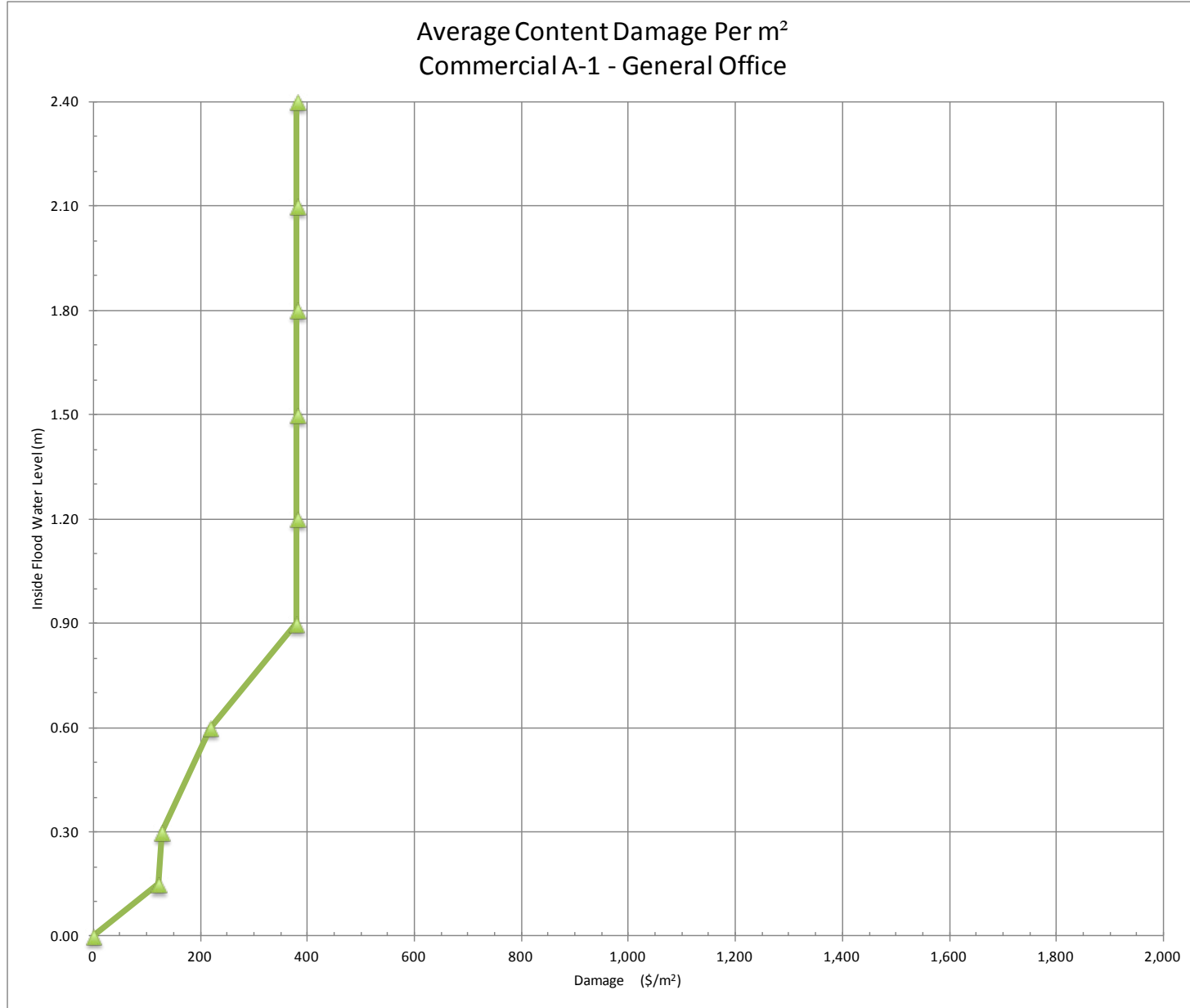
Residential structures damages by interior elevation and classification, Calgary, \$/m2 floor area, 2014\$

Interior elevation		Residential classification								
		A1	A2	B1	B2	C1	C2	D1	MA1	MW1
Top of Level 0 (basement) floor	-2.7	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
	-2.6	\$231	\$241	\$232	\$242	\$237	\$207	\$0	\$0	\$0
	-2.4	\$271	\$354	\$282	\$331	\$309	\$322	\$0	\$0	\$0
	-2.1	\$299	\$406	\$312	\$385	\$356	\$399	\$0	\$0	\$0
	-1.8	\$299	\$406	\$312	\$385	\$356	\$399	\$0	\$0	\$0
	-1.5	\$305	\$429	\$322	\$402	\$374	\$428	\$0	\$0	\$0
	-1.2	\$335	\$466	\$334	\$420	\$383	\$442	\$0	\$0	\$0
	-0.9	\$335	\$466	\$334	\$420	\$383	\$442	\$0	\$0	\$0
Level 0 (basement) ceiling	-0.6	\$356	\$506	\$362	\$470	\$424	\$508	\$0	\$0	\$0
	-0.3	\$357	\$507	\$363	\$473	\$427	\$512	\$27	\$0	\$0
Top of Level 1 (main) floor	0.0	\$365	\$522	\$374	\$490	\$439	\$532	\$27	\$0	\$0
	0.1	\$588	\$665	\$428	\$1,014	\$906	\$1,131	\$362	\$449	\$822
	0.3	\$594	\$676	\$435	\$1,026	\$918	\$1,150	\$405	\$449	\$914
	0.6	\$674	\$826	\$485	\$1,115	\$996	\$1,275	\$405	\$680	\$1,105
	0.9	\$848	\$1,051	\$605	\$1,282	\$1,111	\$1,429	\$470	\$792	\$1,203
	1.3	\$848	\$1,051	\$605	\$1,282	\$1,111	\$1,429	\$470	\$937	\$1,203
	1.5	\$848	\$1,051	\$605	\$1,282	\$1,111	\$1,429	\$470	\$937	\$1,203
	1.8	\$848	\$1,051	\$605	\$1,282	\$1,111	\$1,429	\$470	\$937	\$1,203
	2.1	\$848	\$1,051	\$605	\$1,282	\$1,111	\$1,429	\$470	\$937	\$1,203
Level 1 (main) ceiling	2.4	\$848	\$1,051	\$605	\$1,282	\$1,111	\$1,429	\$470	\$937	\$1,203

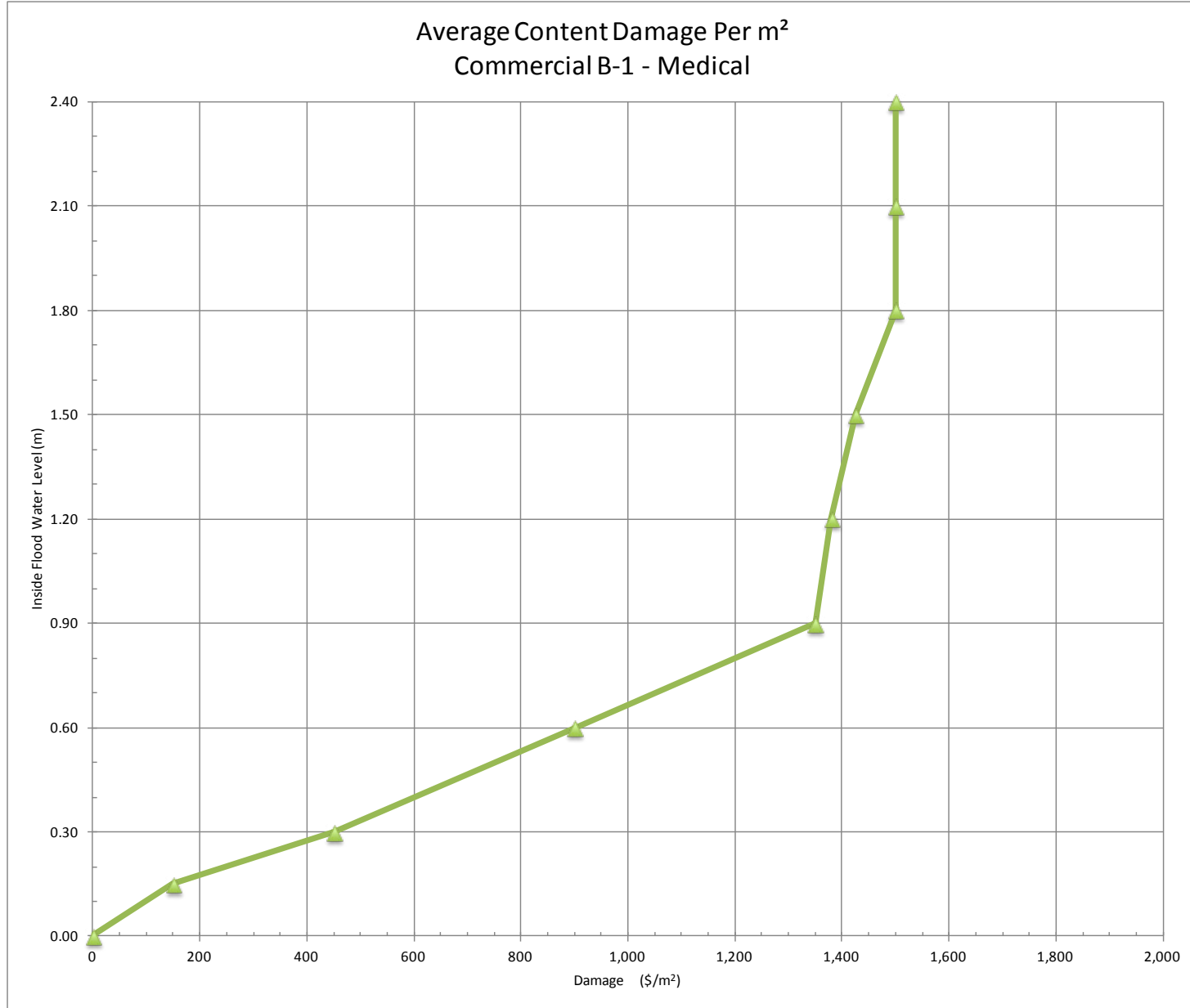
Damages include attached/detached garages; exclude underground parking structures and landscape remediation

Appendix F – Non-Residential Content Damage Curves

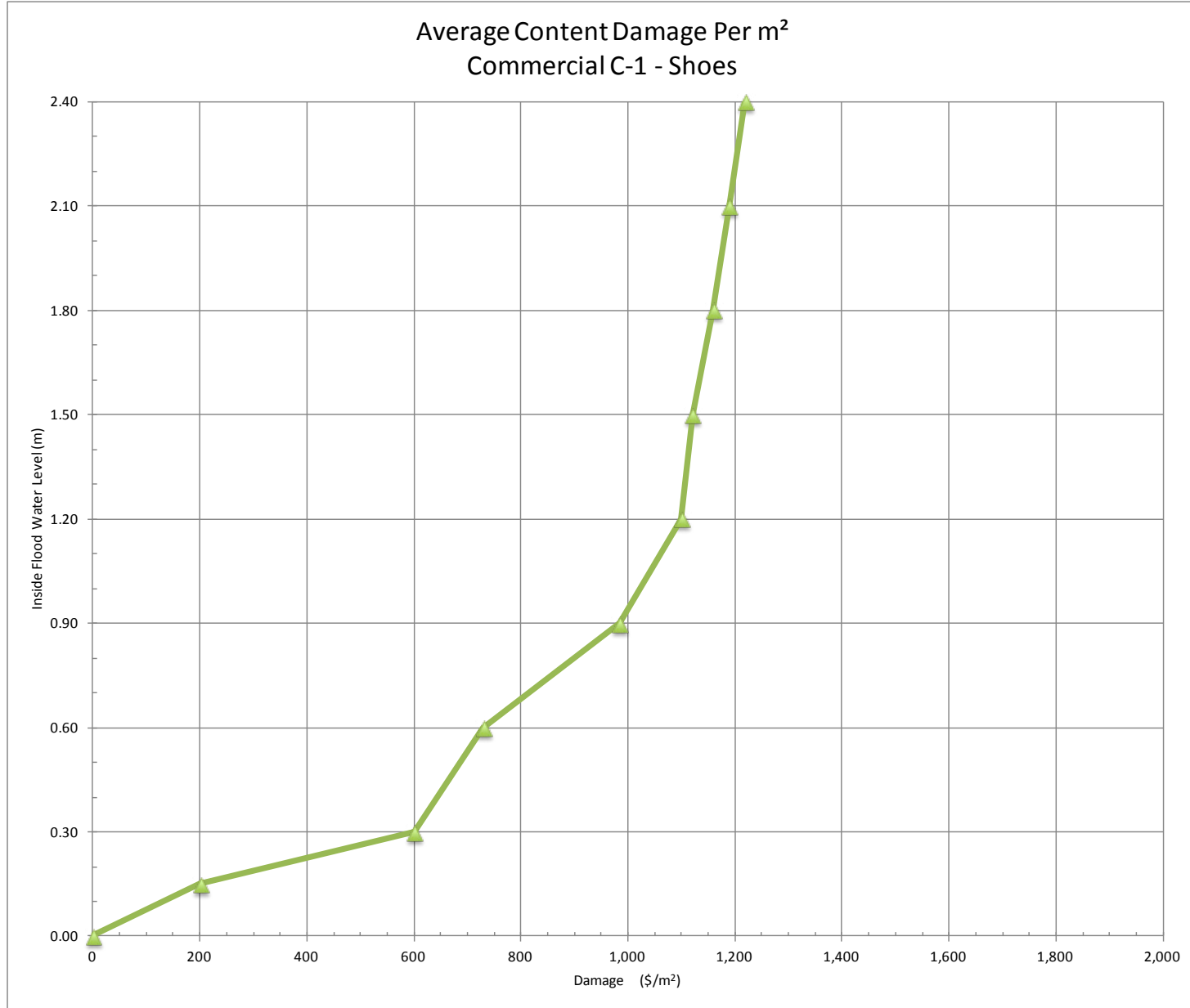
Non-Residential Content Damage Curves



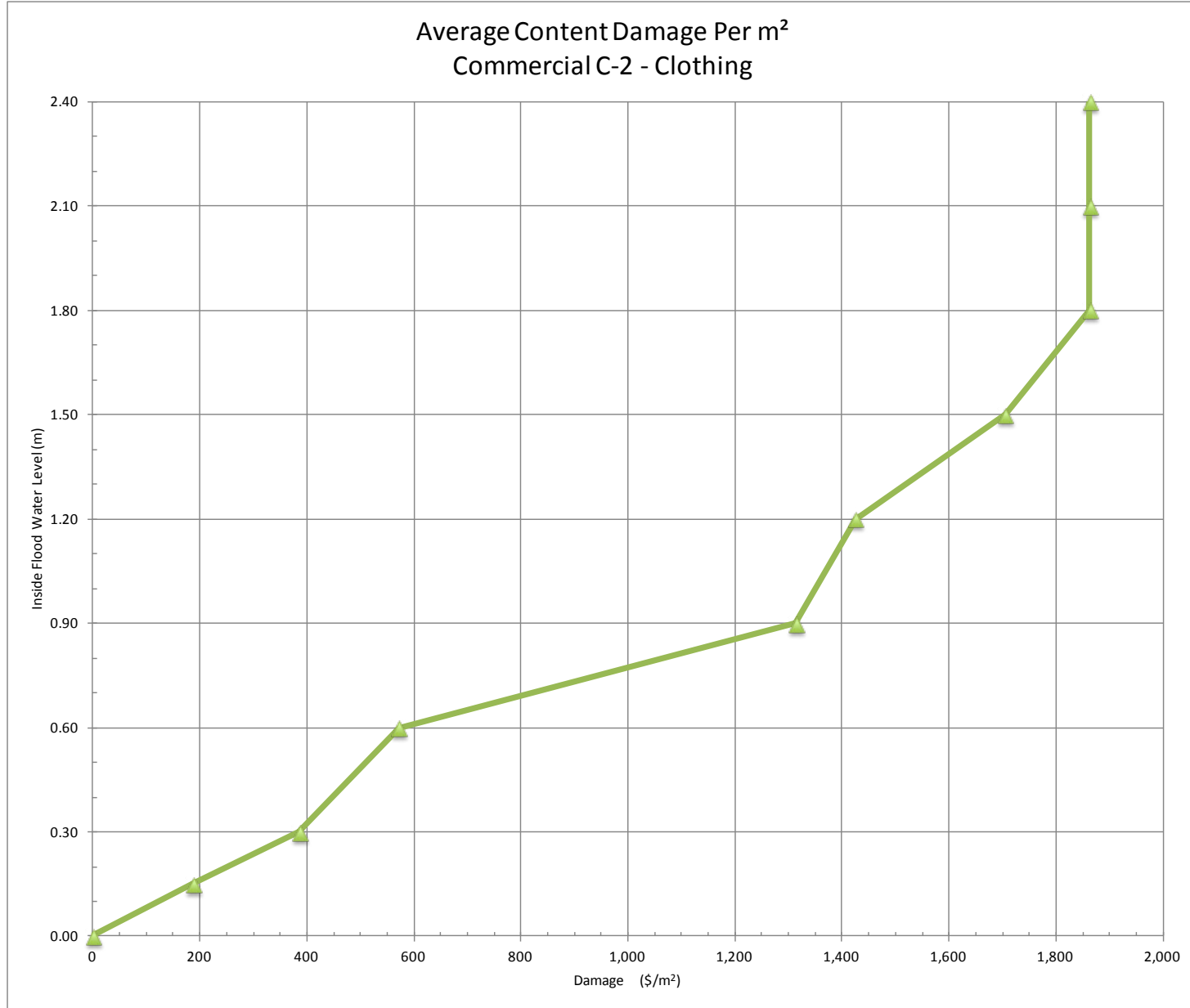
Non-Residential Content Damage Curves



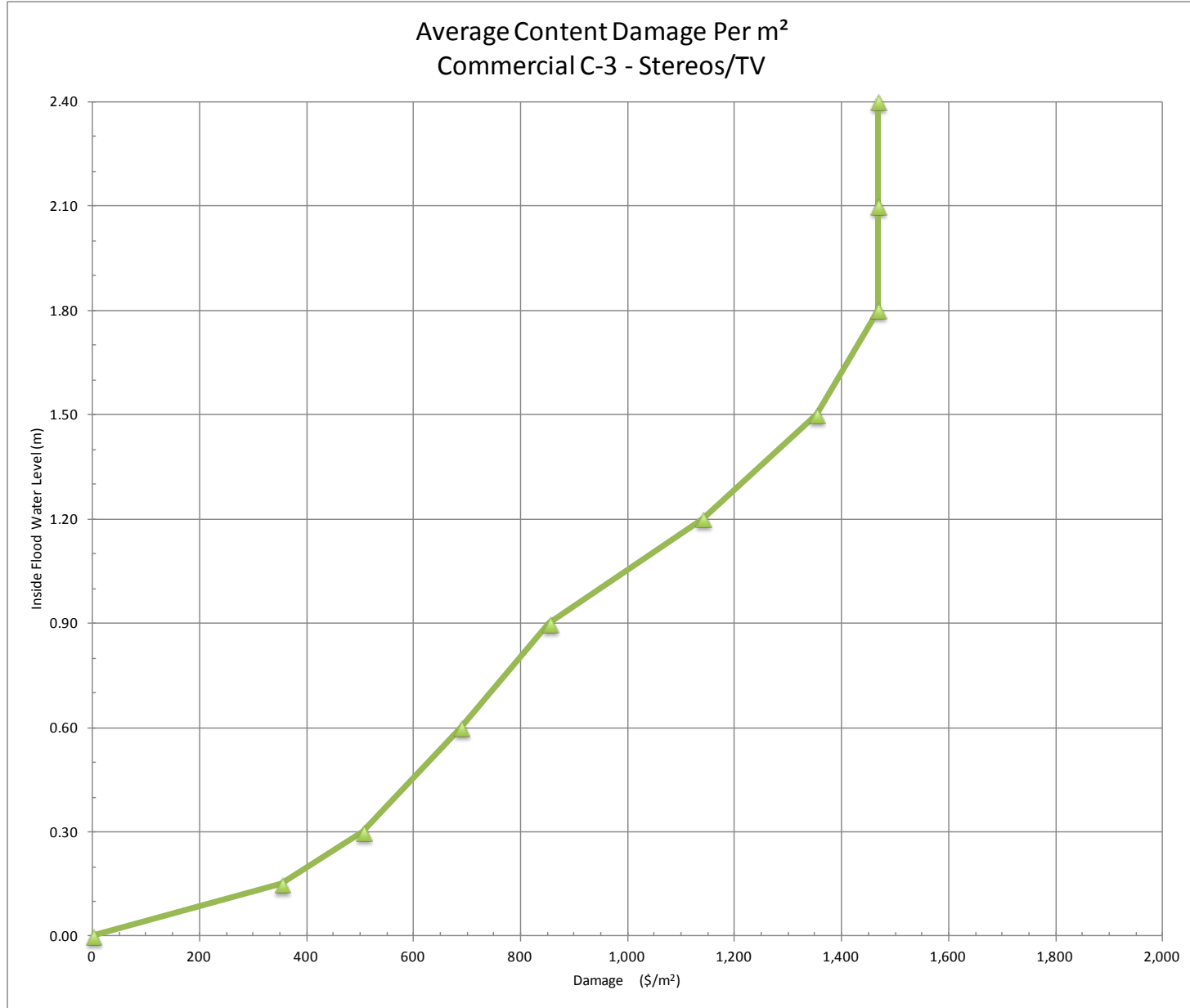
Non-Residential Content Damage Curves



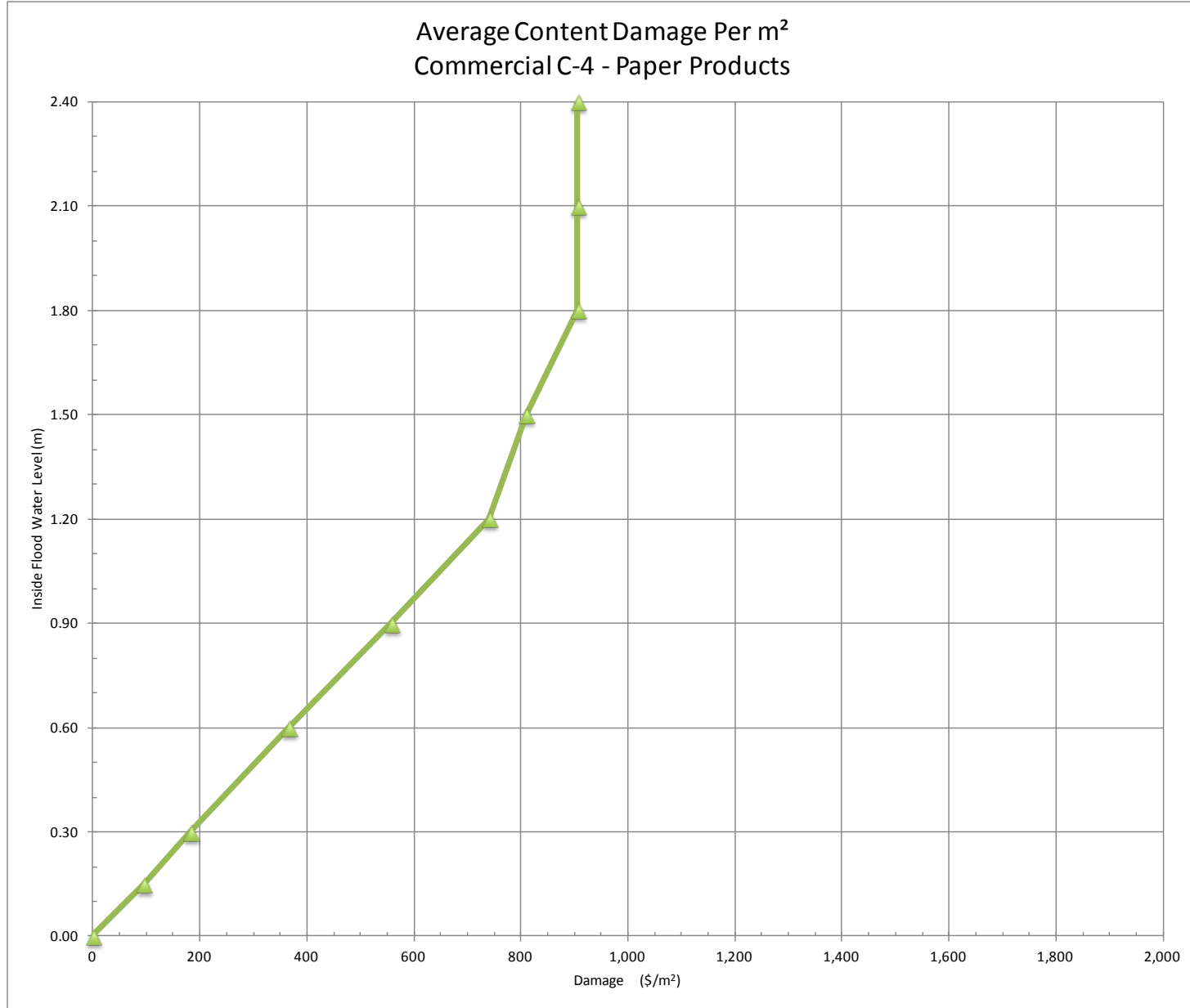
Non-Residential Content Damage Curves



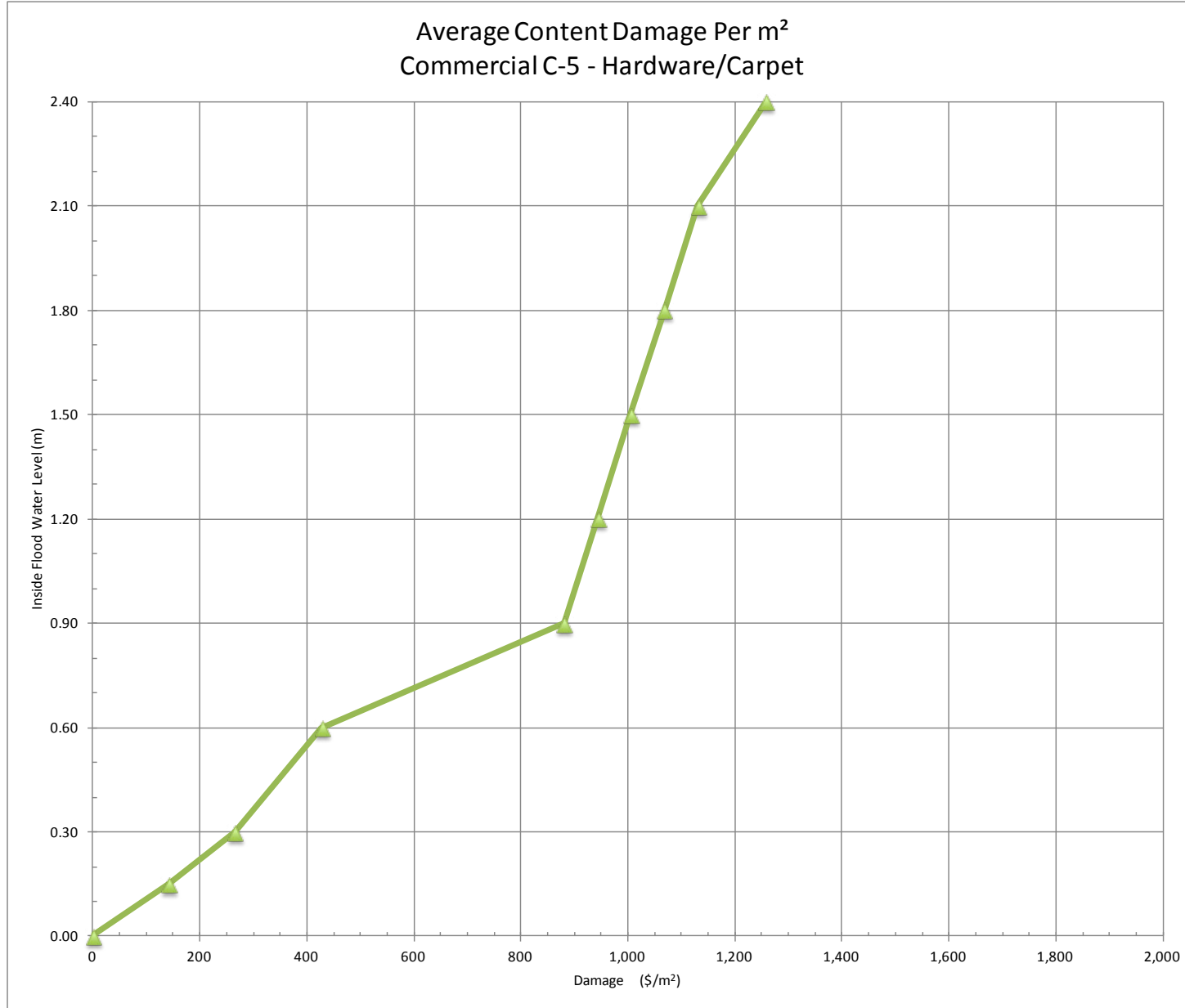
Non-Residential Content Damage Curves



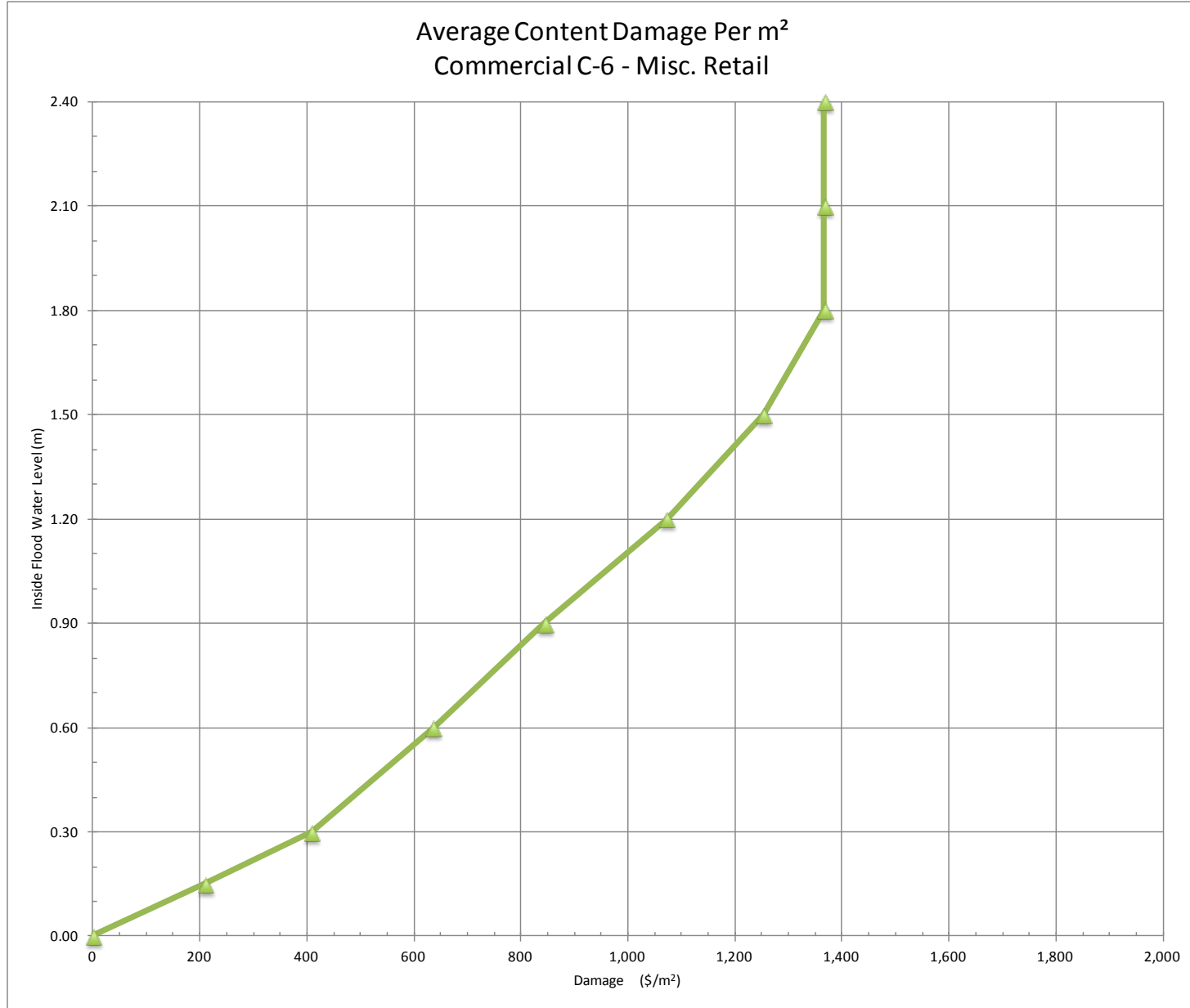
Non-Residential Content Damage Curves



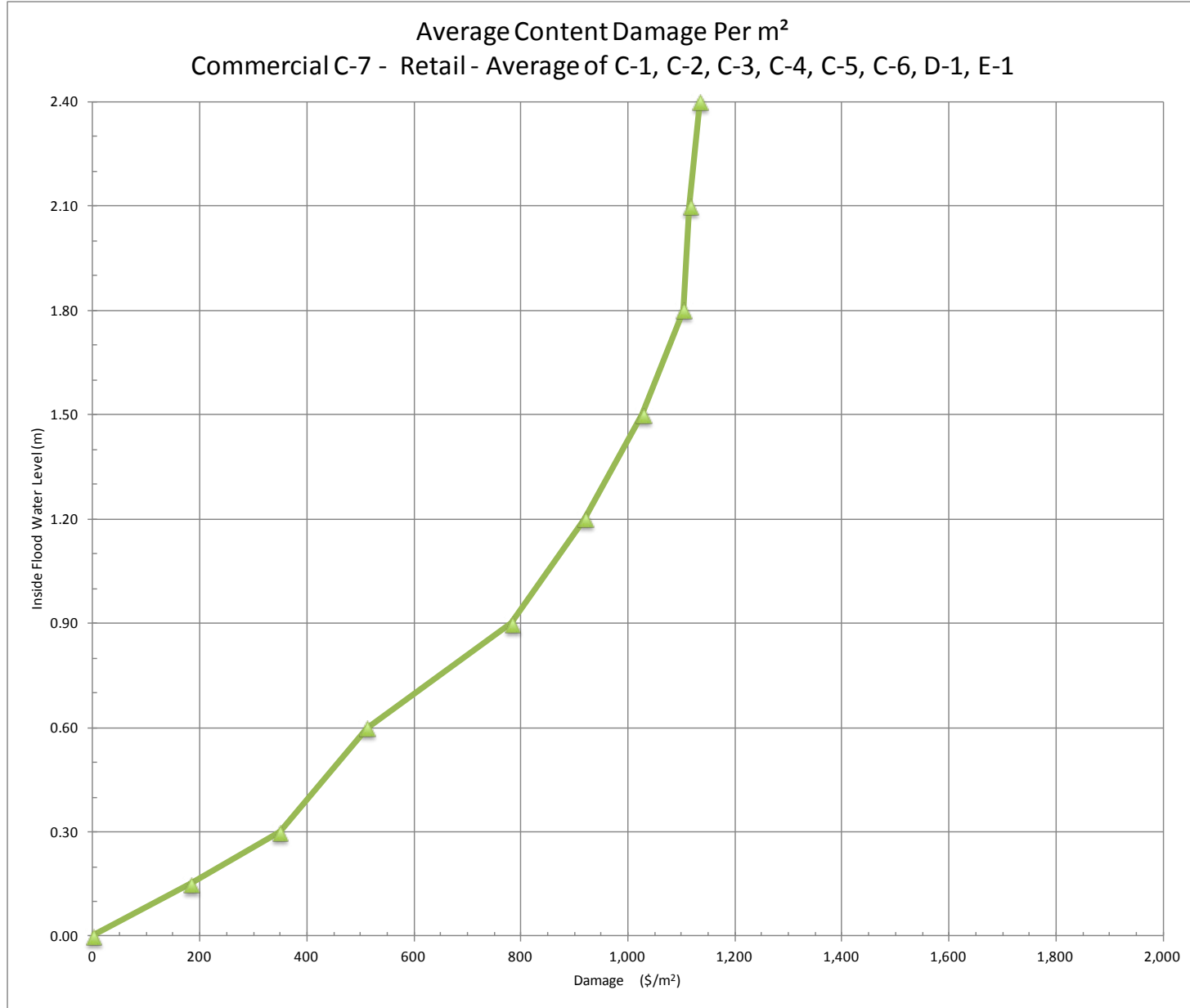
Non-Residential Content Damage Curves



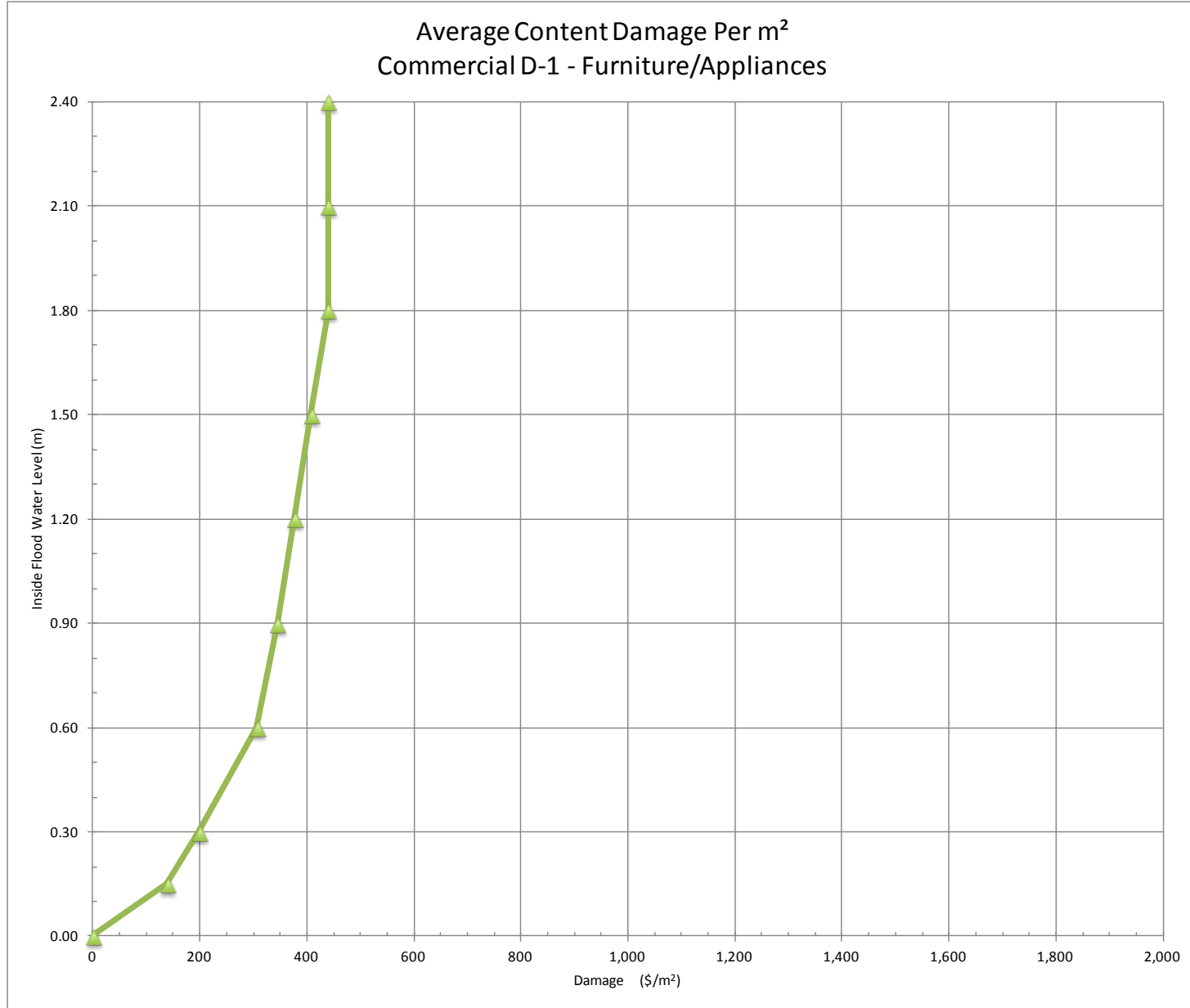
Non-Residential Content Damage Curves



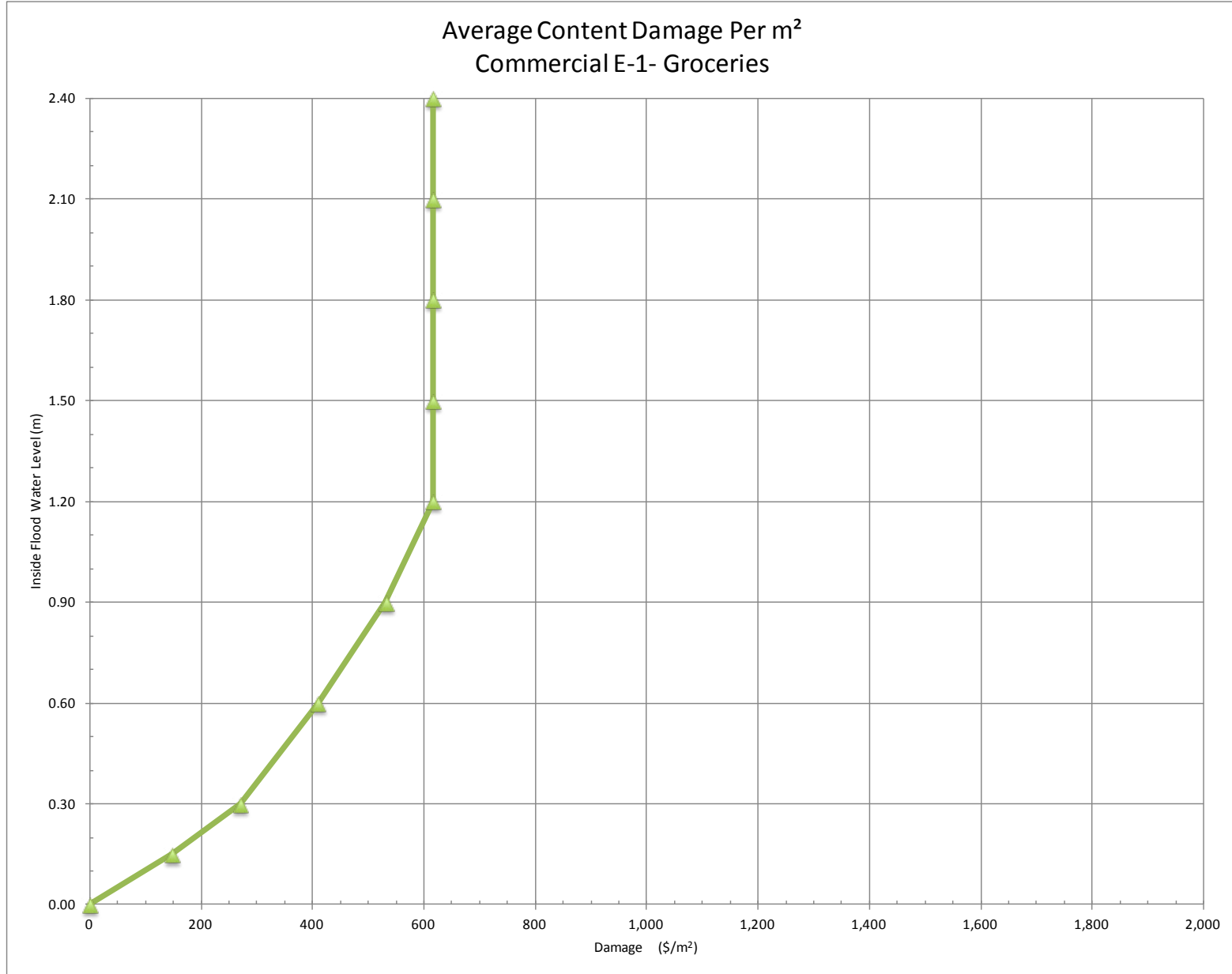
Non-Residential Content Damage Curves



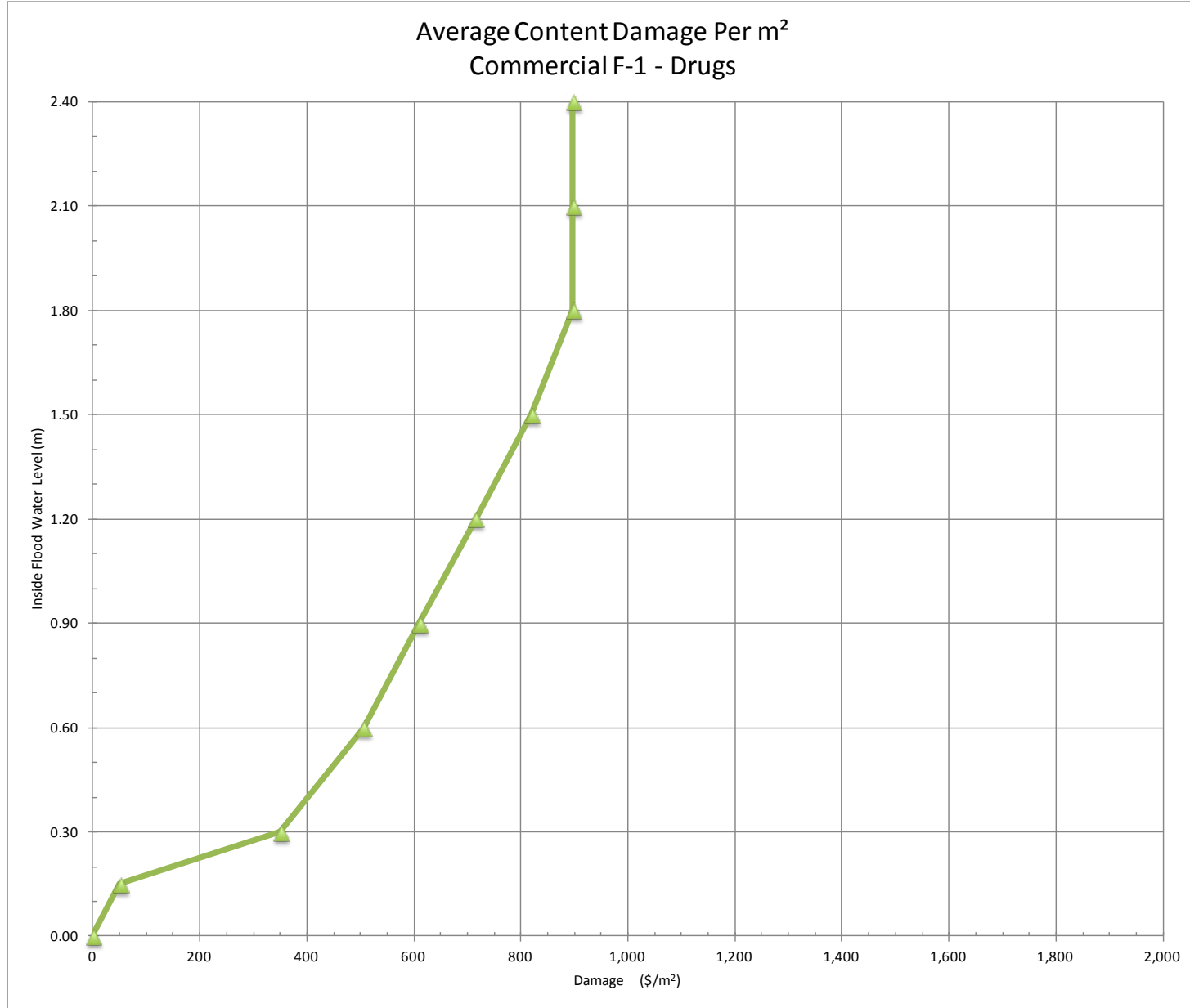
Non-Residential Content Damage Curves



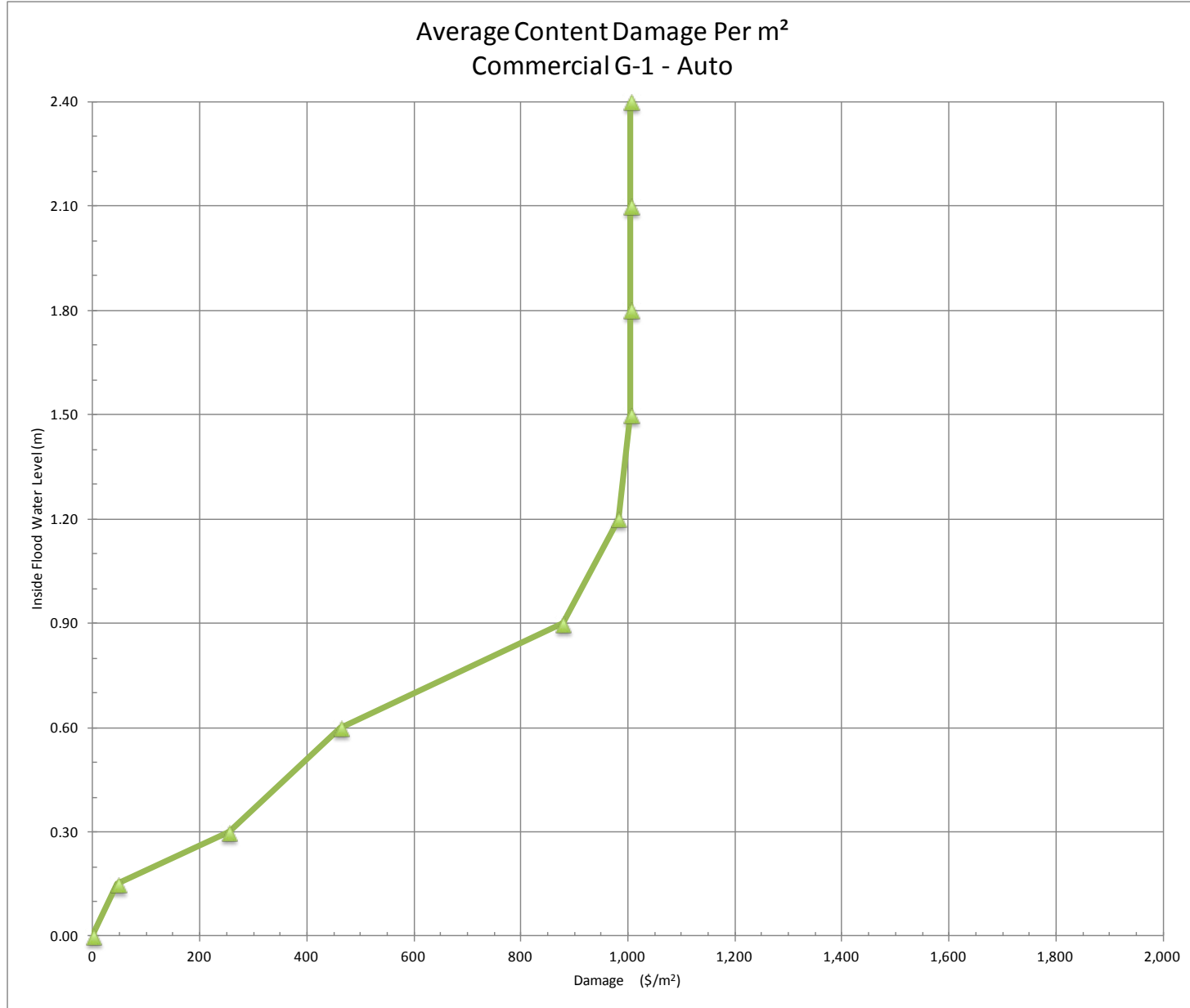
Non-Residential Content Damage Curves



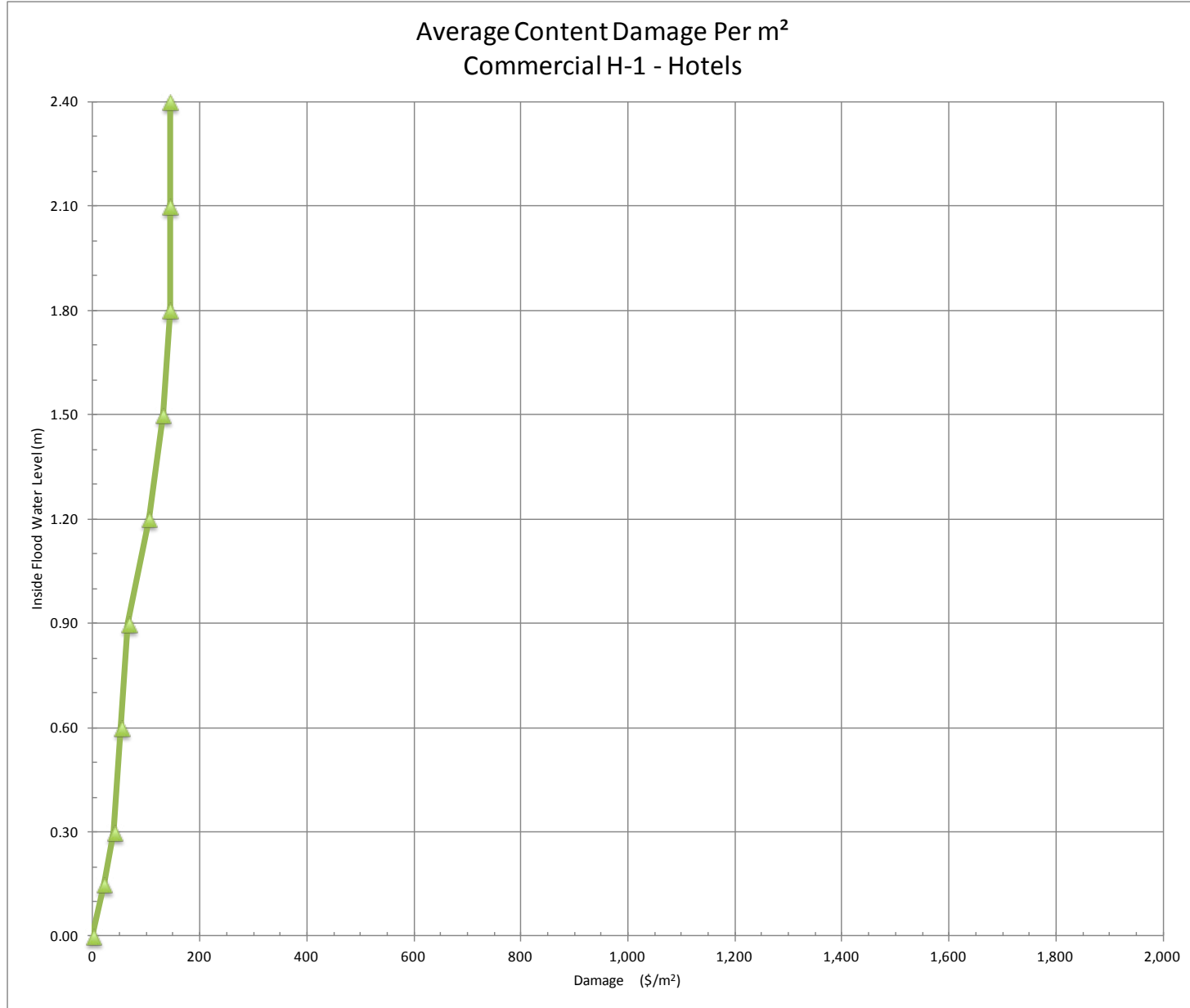
Non-Residential Content Damage Curves



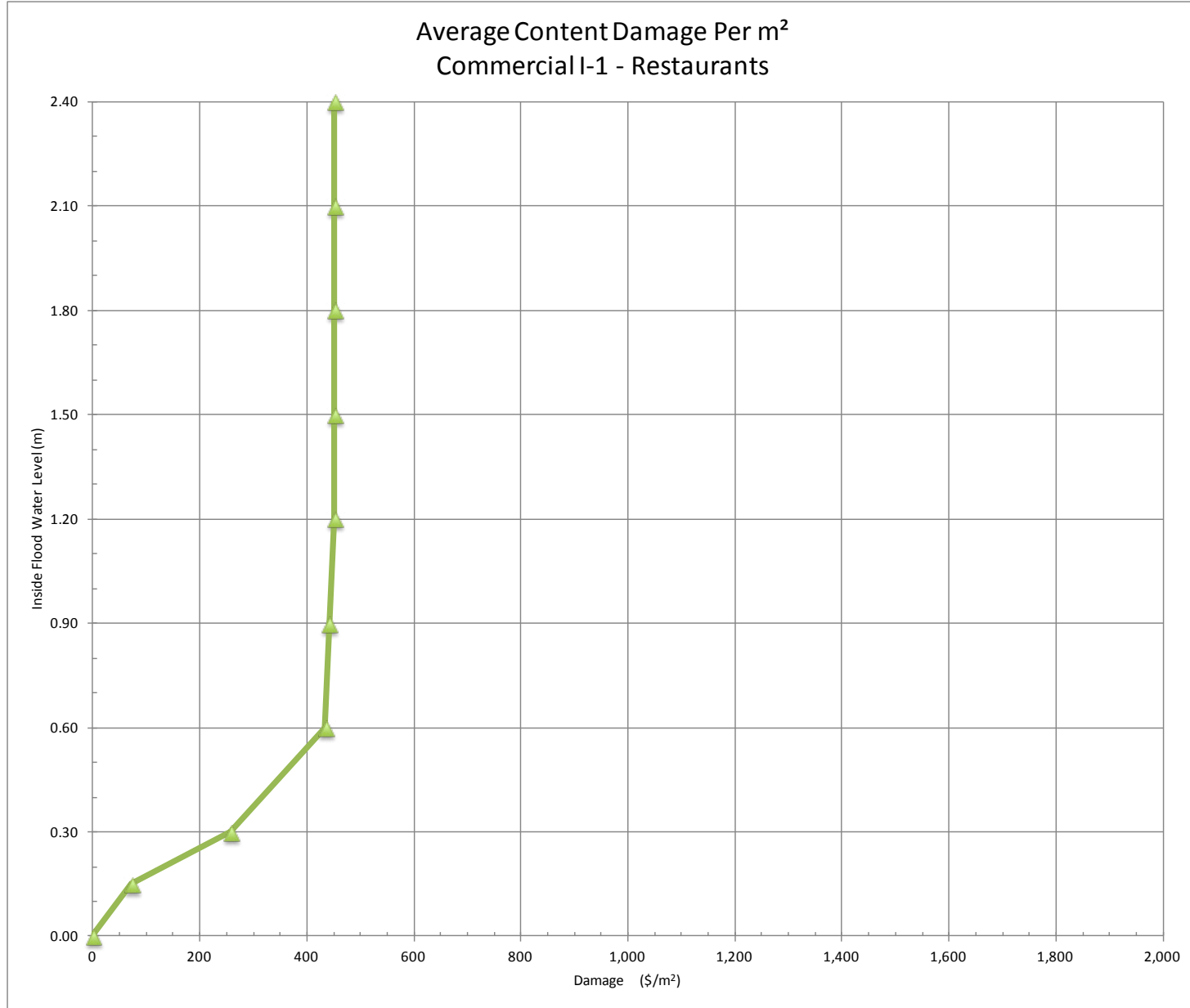
Non-Residential Content Damage Curves



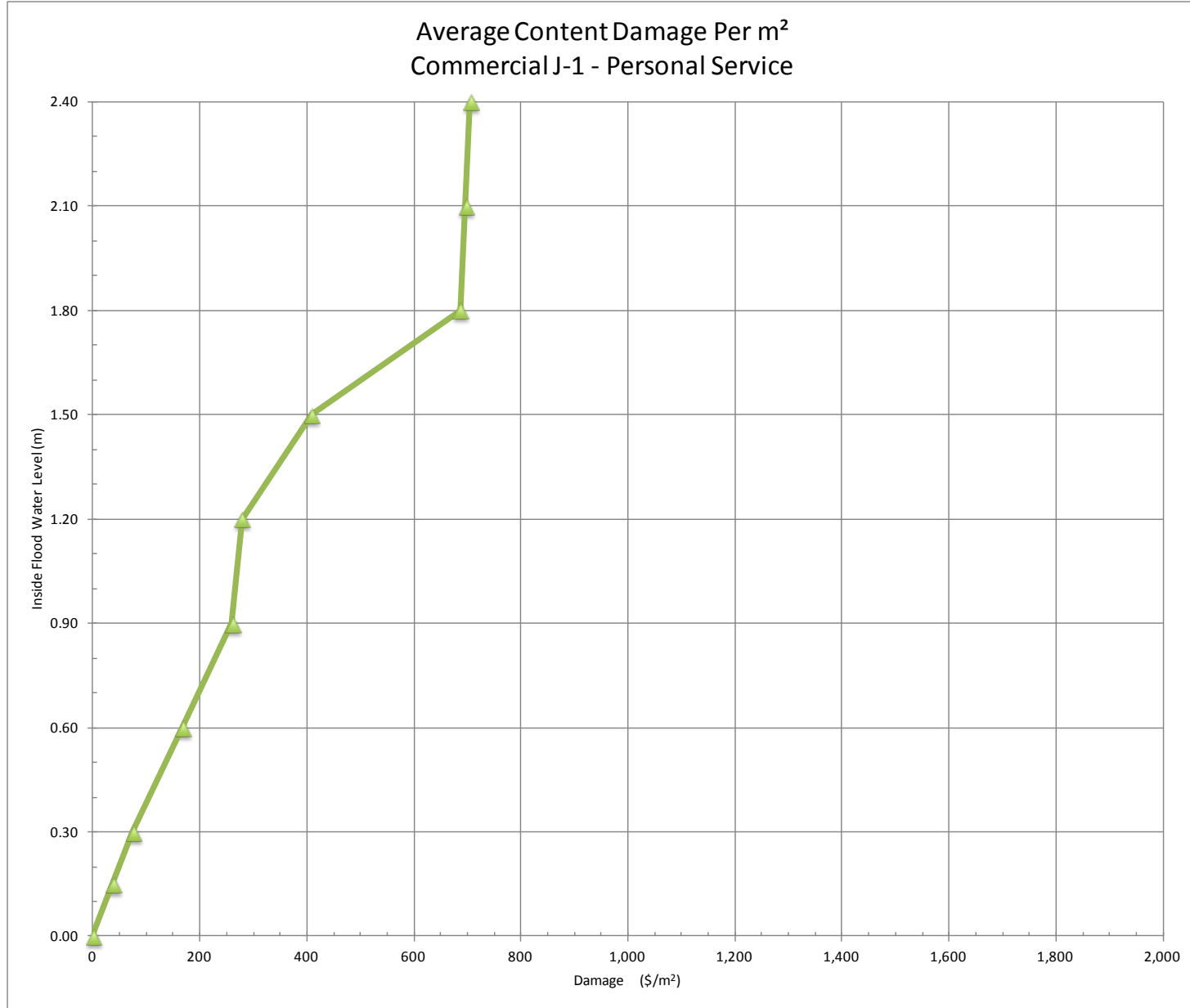
Non-Residential Content Damage Curves



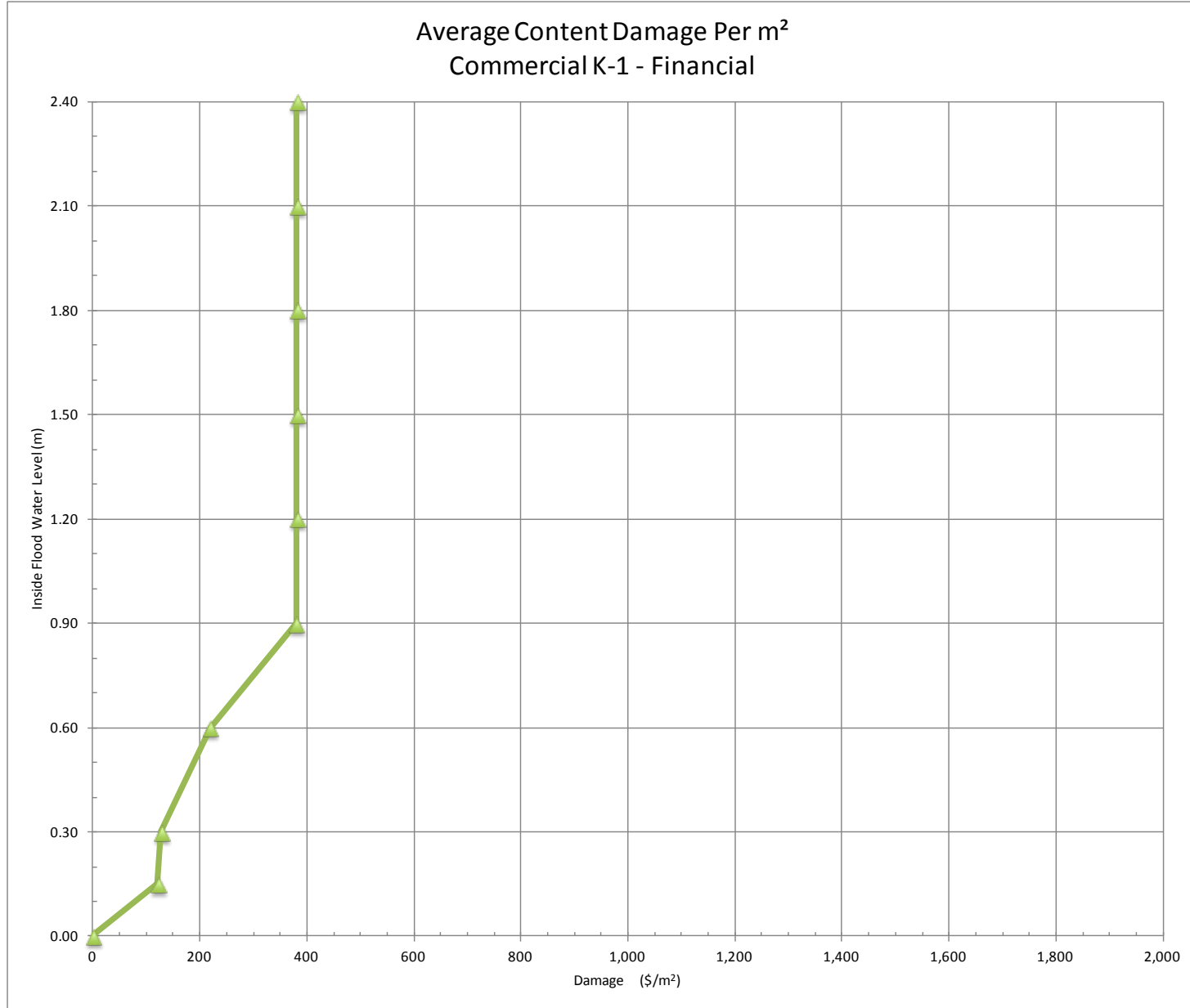
Non-Residential Content Damage Curves



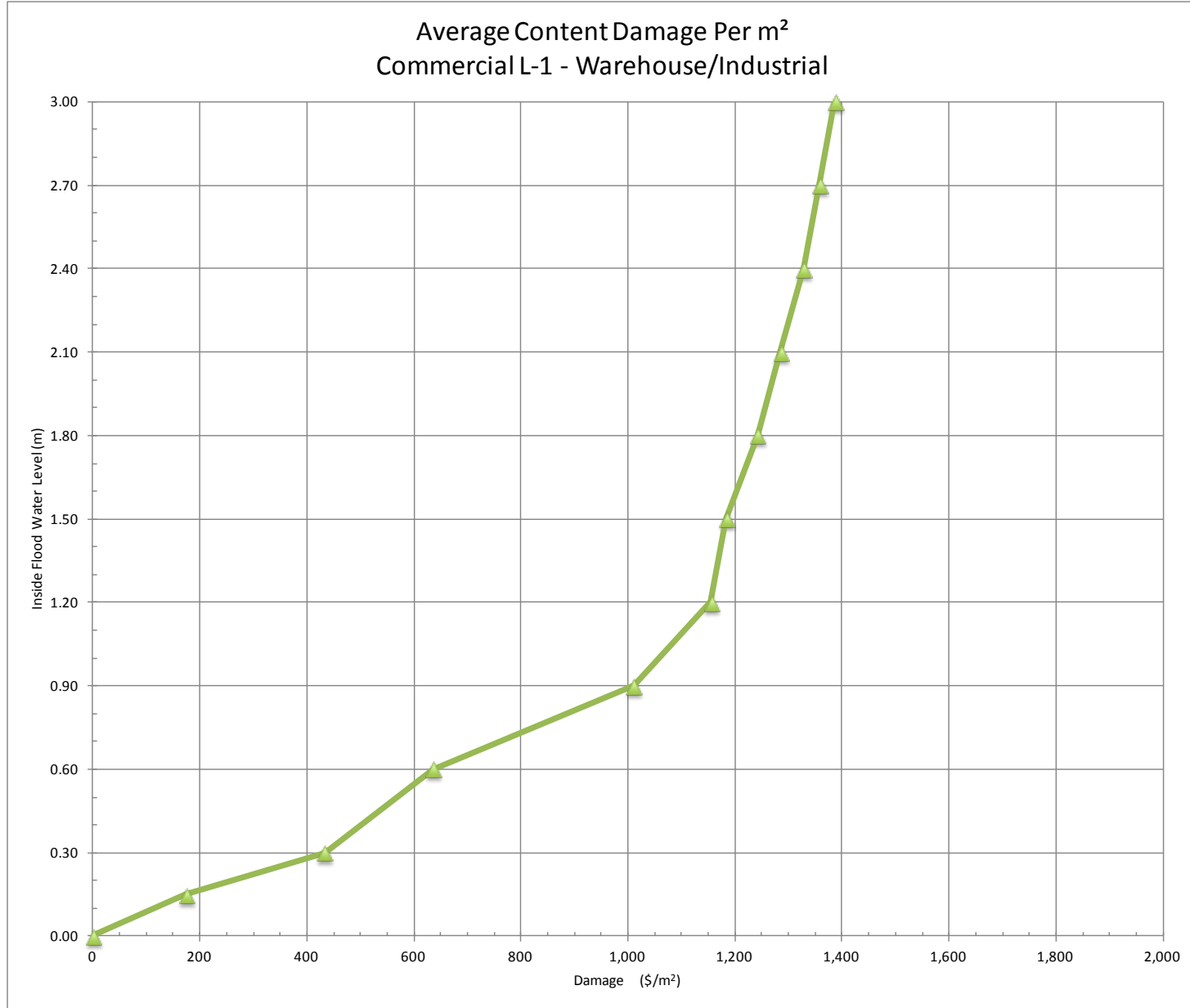
Non-Residential Content Damage Curves



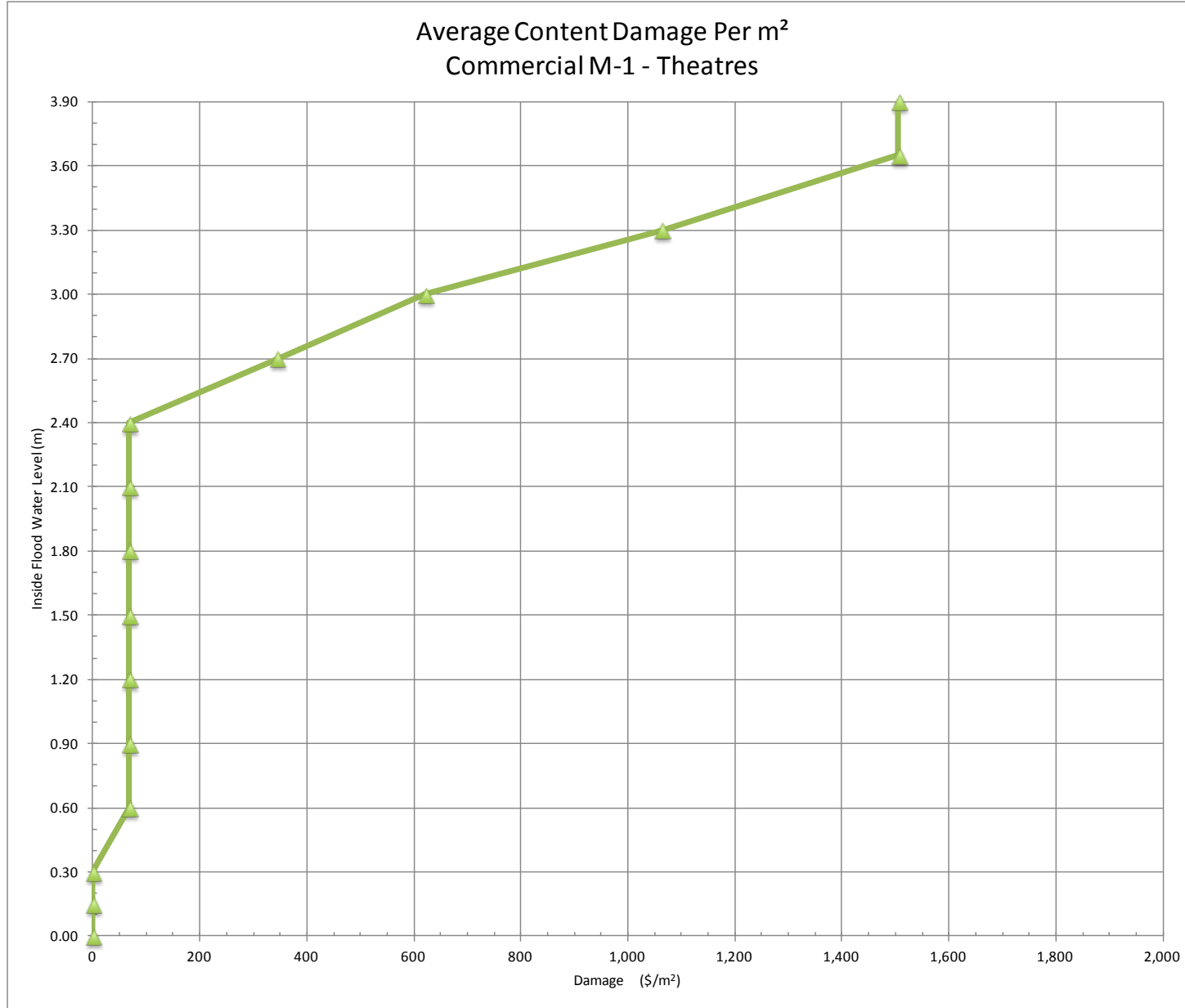
Non-Residential Content Damage Curves



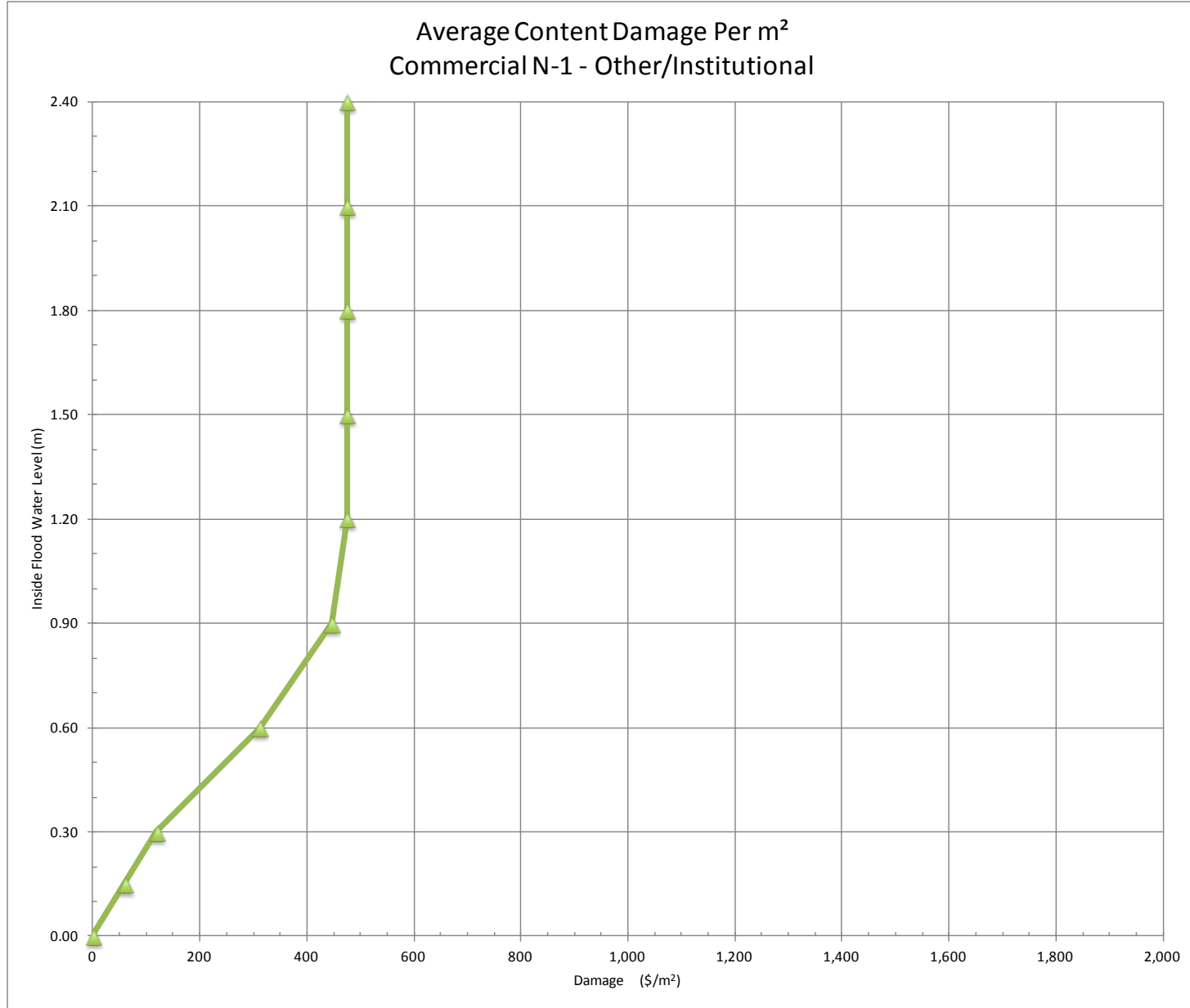
Non-Residential Content Damage Curves



Non-Residential Content Damage Curves



Non-Residential Content Damage Curves



Appendix G – Non-Residential Content Damage Values

Non-Residential Content Damage Values

Non-residential contents damages by interior elevation and classification, Calgary, \$/m2 floor area, 2014\$

Interior elevation	Non-residential classification																					
	A1	B1	C1	C2	C3	C4	C5	C6	C7 Av.	D1	E1	F1	G1	H1	J1	J1	K1	L1	M1	N1	N2	
Top of Level 1 (main floor)	0.0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	0.2	\$121	\$150	\$200	\$187	\$352	\$96	\$142	\$209	\$182	\$138	\$148	\$50	\$46	\$20	\$72	\$37	\$121	\$173	\$0	\$59	\$72
	0.3	\$127	\$450	\$600	\$385	\$504	\$183	\$265	\$408	\$349	\$198	\$270	\$350	\$254	\$39	\$257	\$74	\$127	\$433	\$0	\$119	\$92
	0.6	\$219	\$900	\$729	\$572	\$689	\$366	\$427	\$636	\$512	\$306	\$410	\$505	\$462	\$52	\$434	\$167	\$219	\$635	\$68	\$312	\$182
	0.9	\$380	\$1,350	\$984	\$1,314	\$852	\$557	\$880	\$844	\$782	\$345	\$531	\$610	\$878	\$65	\$442	\$260	\$380	\$1,011	\$68	\$446	\$311
	1.2	\$380	\$1,380	\$1,100	\$1,425	\$1,139	\$740	\$943	\$1,072	\$919	\$376	\$616	\$715	\$982	\$104	\$452	\$278	\$380	\$1,155	\$68	\$475	\$341
	1.5	\$380	\$1,425	\$1,121	\$1,705	\$1,352	\$810	\$1,005	\$1,252	\$1,026	\$408	\$616	\$820	\$1,005	\$131	\$452	\$408	\$380	\$1,184	\$68	\$475	\$363
	1.8	\$380	\$1,500	\$1,159	\$1,862	\$1,467	\$906	\$1,068	\$1,366	\$1,103	\$439	\$616	\$897	\$1,005	\$144	\$452	\$687	\$380	\$1,242	\$68	\$475	\$363
	2.1	\$380	\$1,500	\$1,189	\$1,862	\$1,467	\$906	\$1,130	\$1,366	\$1,115	\$439	\$616	\$897	\$1,005	\$144	\$452	\$696	\$380	\$1,285	\$68	\$475	\$363
	2.4	\$380	\$1,500	\$1,219	\$1,862	\$1,467	\$906	\$1,257	\$1,366	\$1,134	\$439	\$616	\$897	\$1,005	\$144	\$452	\$705	\$380	\$1,328	\$68	\$475	\$363
	2.7	\$380	\$1,500	\$1,219	\$1,862	\$1,467	\$906	\$1,257	\$1,366	\$1,134	\$439	\$616	\$897	\$1,005	\$144	\$452	\$705	\$380	\$1,357	\$344	\$475	\$363
	3.0	\$380	\$1,500	\$1,219	\$1,862	\$1,467	\$906	\$1,257	\$1,366	\$1,134	\$439	\$616	\$897	\$1,005	\$144	\$452	\$705	\$380	\$1,386	\$621	\$475	\$363
	3.3	\$380	\$1,500	\$1,219	\$1,862	\$1,467	\$906	\$1,257	\$1,366	\$1,134	\$439	\$616	\$897	\$1,005	\$144	\$452	\$705	\$380	\$1,386	\$1,063	\$475	\$363
	3.7	\$380	\$1,500	\$1,219	\$1,862	\$1,467	\$906	\$1,257	\$1,366	\$1,134	\$439	\$616	\$897	\$1,005	\$144	\$452	\$705	\$380	\$1,386	\$1,505	\$475	\$363
Level 1 (main) ceiling	3.9	\$380	\$1,500	\$1,219	\$1,862	\$1,467	\$906	\$1,257	\$1,366	\$1,134	\$439	\$616	\$897	\$1,005	\$144	\$452	\$705	\$380	\$1,386	\$1,505	\$475	\$363

Appendix H – Non-Residential Structural Damage Curves

Summary of Specifications for Typical Building – Commercial (Office / Retail)

Structure Poured concrete foundation wall, concrete slab on grade, load bearing masonry wall or light steel frame with steel joist and metal decking, convention or SBS roof.

Ext. Cladding

Walls: -Exposed masonry – unfinished.
 -Exposed masonry – painted.
 -Prefinished metal siding.
 -Stucco on masonry or steel stud.
 -Stone or brick veneer on masonry or steel stud.
 -Wood panels on masonry or steel stud.

Windows: -Prefinished metal with fixed glazing.

Roof: -Conventional 4-ply built-up or SBS on insulation and metal decking.

Interior Finishes

Ground Floor:

Floor: -Concrete slab – painted or unpainted.
 -Linoleum or VCT on concrete slab.
 -Ceramic tile on concrete slab.
 -Carpet on concrete slab.
 -Wood laminate on concrete slab.

Walls: -Drywall on steel stud - painted.

Doors: -Solid / hollow core wood.

Ceiling: -Suspended drywall or acoustic tile.

Washrooms: -Cabinets, plywood body, solid wood doors and drawers, P-Lam counters.

Mechanical -Packaged heating and cooling units on roof. Zoned per level.

Note: -Where two or more materials are shown, unit costs have been averaged.

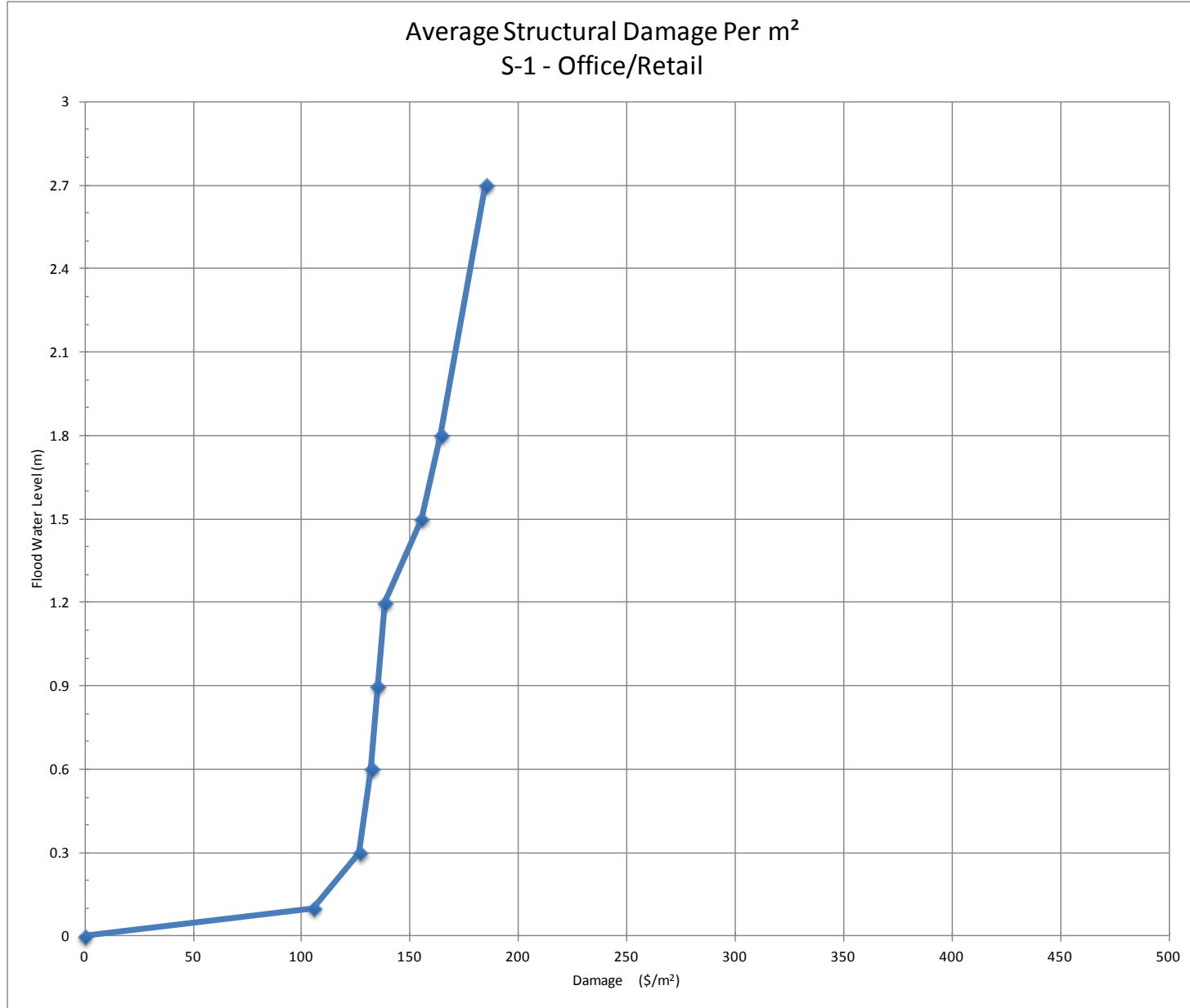
Flood Damage Study

Commercial (Office / Retail)

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
Ground Floor							
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Check and clean heating units. • Clean and sanitize all structural components after demolition is completed. • Clean and sanitize all exterior building finishes. • Implement structural drying. 	108	m ²	\$65	\$7,020		
		195	m ²	\$90	\$17,550		
		97	linear m	\$6	\$582		
		8	hours	\$75	\$600		
		16	hour	\$125	\$2,000		
		16	hour	\$125	\$2,000		
		24	hour	\$75	\$1,800		
						\$31,552	\$31,552
0.3	<ul style="list-style-type: none"> • Remove and replace drywall 150mm above soak line. • Remove and replace insulation 150mm above soak line. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove, clean and re-install washroom toilet and sink. • Remove and replace washroom cabinets. • Remove and replace hot water heater. 	43	m ²	\$30	\$1,290		
		18	m ²	\$3	\$45		
		6	door	\$350	\$2,100		
		6	opening	\$90	\$540		
		1	washroom	\$500	\$500		
		1	cabinet	\$750	\$750		
		1	unit	\$1,200	\$1,200		
						\$6,425	\$37,977
0.6	<ul style="list-style-type: none"> • Remove and replace drywall 150mm above soak line. • Remove and replace insulation 150mm above soak line. • Remove and replace electrical outlets and check wiring. 	29	m ²	\$30	\$870		
		12	m ²	\$3	\$30		
		10	hour	\$75	\$750		
						\$1,650	\$39,627

Datum	Description of Restoration	Cost to Repair					Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	Total	
0.9	• Remove and replace drywall 150mm above soak line.	29	m ²	\$30	\$870	\$900	\$40,527
	• Remove and replace insulation 150mm above soak line.	12	m ²	\$3	\$30		
1.2	• Remove and replace drywall 150mm above soak line.	29	m ²	\$30	\$870	\$900	\$41,427
	• Remove and replace insulation 150mm above soak line.	12	m ²	\$3	\$30		
1.5	• Remove and replace drywall 150mm above soak line.	29	m ²	\$30	\$870	\$5,100	\$46,527
	• Remove and replace insulation 150mm above soak line.	12	m ²	\$3	\$30		
	• Remove and replace electrical switches and wiring back to the service panel.	16	hour	\$75	\$1,200		
	• Remove and replace electrical service panel.	2	panel	\$1,500	\$3,000		
1.8 – 2.4	• Remove and replace drywall to full height.	86	m ²	\$30	\$2,580	\$2,670	\$49,197
	• Remove and replace insulation to full height.	36	m ²	\$3	\$90		
2.7 (Ceiling)	• Remove and replace ceiling system.	115	m ²	\$30	\$3,450	\$6,250	\$55,447
	• Remove and replace electrical light fixtures.	10	fixture	\$200	\$2,000		
	• Caulk at exterior windows.	4	window	\$200	\$800		
Grand Total						\$55,447	\$55,447

Non-Residential Structural Damage Curves



Summary of Specifications for Typical Building – Commercial (Industrial / Warehouse)

<u>Structure</u>	Poured concrete foundation wall, concrete slab on grade, load bearing masonry wall or Systems steel frame with steel joist and metal decking or metal prefinished systems roof.
<u>Ext. Cladding</u>	Walls: -Exposed masonry – unfinished. -Exposed masonry – painted. -Prefinished metal siding. Windows: -Prefinished metal with fixed glazing. Roof: -Conventional 4-ply built-up membrane on insulation and metal decking. - Insulated sloping metal systems roof.
<u>Interior Finishes</u>	
Ground Floor:	Floor: -Concrete slab – painted or unpainted. -Linoleum or VCT on concrete slab. -Ceramic tile on concrete slab. -Carpet on concrete slab. Walls: -Drywall on steel stud - painted. Doors: -Solid / hollow core wood. Ceiling: -Suspended drywall or acoustic tile. Washrooms: -Cabinets, plywood body, solid wood doors and drawers, P-Lam counters.
<u>Mechanical</u>	-Packaged heating and cooling units on roof. Zoned per level.
Note:	-Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

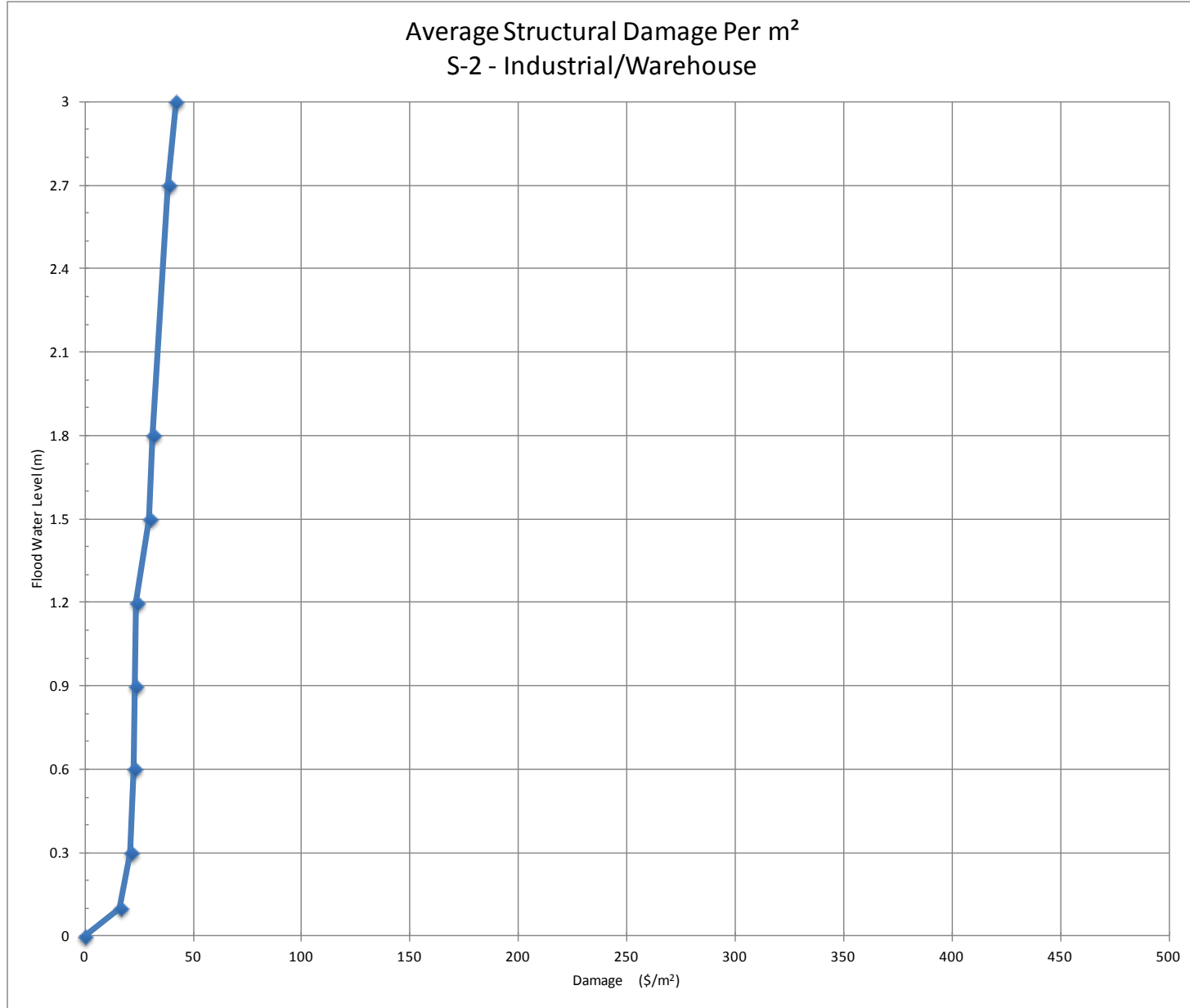
Commercial (Industrial / Warehouse)

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
Ground Floor	<ul style="list-style-type: none"> Remove existing flooring. Clean and prepare slab. Install new flooring. Remove existing carpet. Clean slab & install new carpeting. Remove and replace baseboards. Check and clean heating units. Clean and sanitize all structural components after demolition is completed. Clean and sanitize all exterior building finishes. Implement structural drying. 	87	m ²	\$65	\$5,655	
		8	m ²	\$90	\$720	
		49	linear m	\$6	\$294	
		4	hours	\$75	\$300	
		16	hour	\$125	\$2,000	
		16	hour	\$125	\$2,000	
		24	hour	\$75	\$1,800	
					\$12,769	
0.3	<ul style="list-style-type: none"> Remove and replace drywall 150mm above soak line. Remove and replace insulation 150mm above soak line. Remove and replace all doors & hardware. Remove and replace all wood casings and door jambs. Remove, clean and re-install washroom toilet and sink. Remove and replace washroom cabinets. Remove and replace hot water heater. 	22	m ²	\$30	\$660	
		23	m ²	\$3	\$58	
		2	door	\$350	\$700	
		2	opening	\$90	\$180	
		1	washroom	\$500	\$500	
		1	cabinet	\$750	\$750	
		1	unit	\$1,200	\$1,200	
					\$4,048	
0.6	<ul style="list-style-type: none"> Remove and replace drywall 150mm above soak line. 	15	m ²	\$30	\$450	

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
0.9	• Remove and replace insulation 150mm above soak line.	16	m ²	\$3	\$40	\$1,240
	• Remove and replace electrical outlets and check wiring.	10	hour	\$75	\$750	
	• Remove and replace drywall 150mm above soak line.	15	m ²	\$30	\$450	
	• Remove and replace insulation 150mm above soak line.	16	m ²	\$3	\$40	
1.2	• Remove and replace drywall 150mm above soak line.	15	m ²	\$30	\$450	\$490
	• Remove and replace insulation 150mm above soak line.	16	m ²	\$3	\$40	
1.5	• Remove and replace drywall 150mm above soak line.	15	m ²	\$30	\$450	\$4,690
	• Remove and replace insulation 150mm above soak line.	16	m ²	\$3	\$40	
	• Remove and replace electrical switches and wiring back to the service panel.	16	hour	\$75	\$1,200	
	• Remove and replace electrical service panel.	2	panel	\$1,500	\$3,000	
1.8 – 2.4	• Remove and replace drywall to full height.	43	m ²	\$30	\$1,290	\$1,405
	• Remove and replace insulation to full height.	46	m ²	\$3	\$115	

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
2.7 (Ceiling)	<ul style="list-style-type: none"> Remove and replace ceiling system. Caulk at exterior windows. 	158	m ²	\$30	\$4,740	\$5,540
		4	window	\$200	\$800	
3.0 – 4.2	<ul style="list-style-type: none"> Service and repair HVAC systems. Remove and replace electrical light fixtures. 	12	hour	\$75	\$900	\$2,900
		10	fixture	\$200	\$2,000	
Grand Total						\$33,572

Non-Residential Structural Damage Curves



Summary of Specifications for Typical Building – Commercial (Hotel / Motel)

Structure

Poured concrete foundation wall, concrete slab on grade, load bearing masonry wall or steel frame with steel joist and concrete slab.

Ext. Cladding

Walls: -Steel studs, gypsum sheathing and brick veneer.

Windows: -Prefinished metal or aluminum sliders in wood frames.

Roof: -Conventional 4-ply built-up or SBS on insulation and metal decking.

Interior Finishes

Ground Floor:

Floor: -Linoleum
-VCT tile
-Laminate
-Carpet

Walls: -Drywall painted.

Ceiling: -Drywall stippled.

Insulation: -Walls (R12)
-Ceiling (R20)
-6mil poly V.B.

Cabinets: -Plywood body, solid wood doors and drawers, P-Lam counters.

Bathroom: -Tile to ceiling above tub or fibreglass tub enclosure.

Note:

-Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

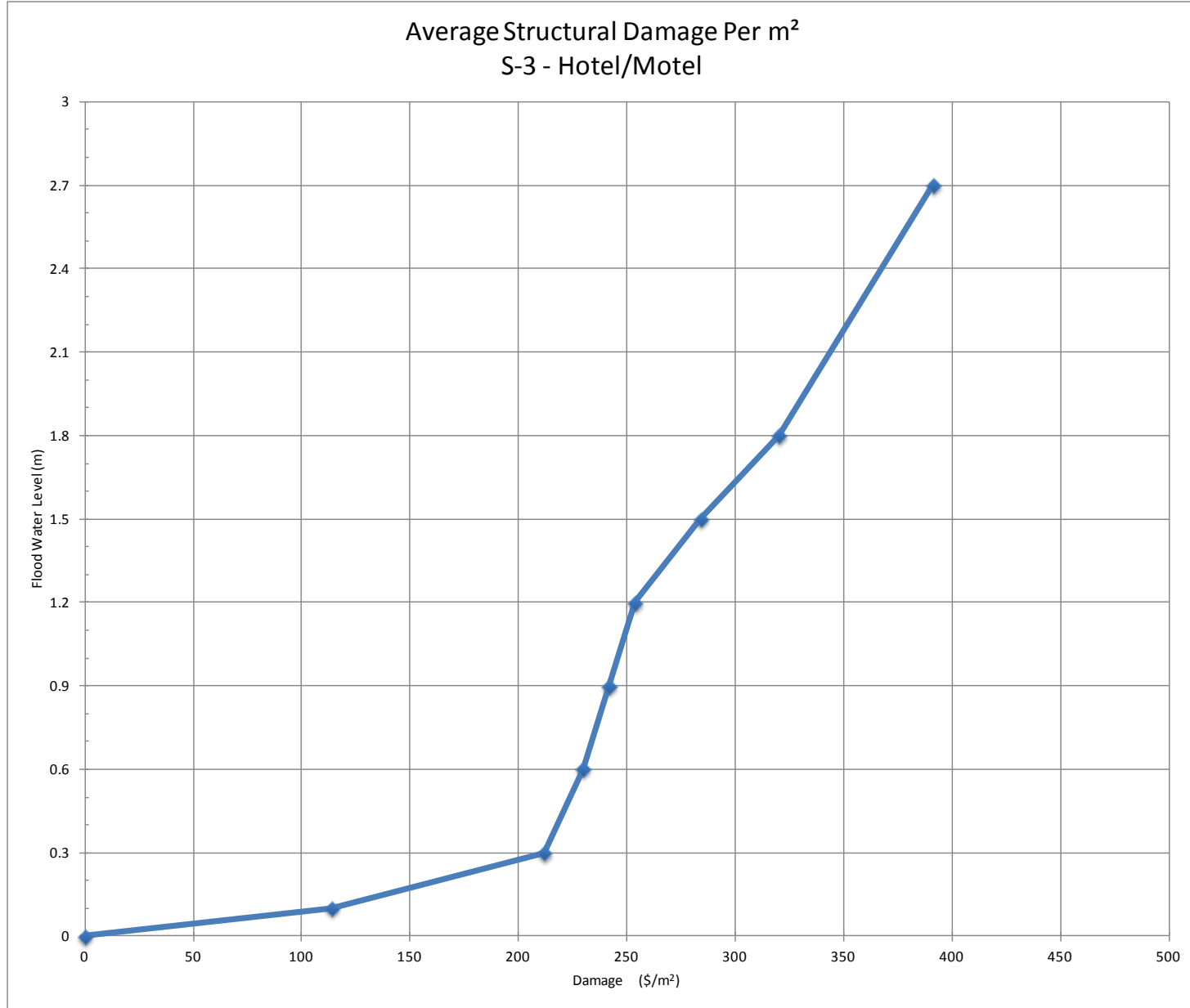
Commercial (Hotel / Motel)

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
Ground Floor	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean slab & install new carpeting. • Remove and replace baseboards. • Check and clean heating units. • Clean and sanitize all structural components after demolition is completed. • Clean and sanitize all exterior building finishes. • Implement structural drying. 	125	m ²	\$65	\$8,125	
		125	m ²	\$90	\$11,250	
		330	linear m	\$6	\$1,980	
		16	hours	\$75	\$1,200	
		16	hour	\$125	\$2,000	
		16	hour	\$125	\$2,000	
		24	hour	\$75	\$1,800	
					\$28,355	
0.3	<ul style="list-style-type: none"> • Remove and replace drywall 150mm above soak line. • Remove and replace insulation 150mm above soak line. • Remove and replace all doors & hardware. • Remove and replace all wood casings and door jambs. • Remove, clean and re-install washroom toilet and sink. • Remove and replace washroom cabinets. • Remove and replace hot water heater. 	148	m ²	\$30	\$4,440	
		40	m ²	\$3	\$100	
		20	door	\$350	\$7,000	
		20	opening	\$90	\$1,800	
		8	washroom	\$500	\$4,000	
		8	cabinet	\$750	\$6,000	
		1	unit	\$1,200	\$1,200	
					\$24,540	
0.6	<ul style="list-style-type: none"> • Remove and replace drywall 150mm above soak line. 	98	m ²	\$30	\$2,940	

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
0.9	<ul style="list-style-type: none"> Remove and replace insulation 150mm above soak line. Remove and replace electrical outlets and check wiring. 	26	m ²	\$3	\$65	\$4,505
	20	hour	\$75	\$1,500		
1.2	<ul style="list-style-type: none"> Remove and replace drywall 150mm above soak line. Remove and replace insulation 150mm above soak line. 	98	m ²	\$30	\$2,940	\$3,005
	26	m ²	\$3	\$65		
1.5	<ul style="list-style-type: none"> Remove and replace drywall 150mm above soak line. Remove and replace insulation 150mm above soak line. 	98	m ²	\$30	\$2,940	\$3,005
	26	m ²	\$3	\$65		
1.8 – 2.4	<ul style="list-style-type: none"> Remove and replace drywall 150mm above soak line. Remove and replace insulation 150mm above soak line. Remove and replace electrical switches and wiring back to the service panel. Remove and replace electrical service panel. 	98	m ²	\$30	\$2,940	\$7,505
	26	m ²	\$3	\$65		
	20	hour	\$75	\$1,500		
	2	panel	\$1,500	\$3,000		
1.8 – 2.4	<ul style="list-style-type: none"> Remove and replace drywall to full height. Remove and replace insulation to full height. 	295	m ²	\$30	\$8,850	\$9,048
	79	m ²	\$3	\$198		

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
2.7 (Ceiling)	<ul style="list-style-type: none"> • Remove and replace ceiling system. • Remove and replace electrical light fixtures. • Caulk at exterior windows. 	405	m ²	\$30	\$12,150	\$17,750
		20	fixture	\$200	\$4,000	
		8	window	\$200	\$1,600	
Grand Total					\$97,713	

Non-Residential Structural Damage Curves



Insulation: -Acoustic fire batt insulation (int.).
-Rigid board insulation (ext.).
-Breathable vapour barrier membrane.

Cabinets: Plywood body, solid wood doors and drawers, P-Lam counters.

Bathroom: Tile to ceiling above tub.

Note: -Where two or more materials are shown, unit costs have been averaged.

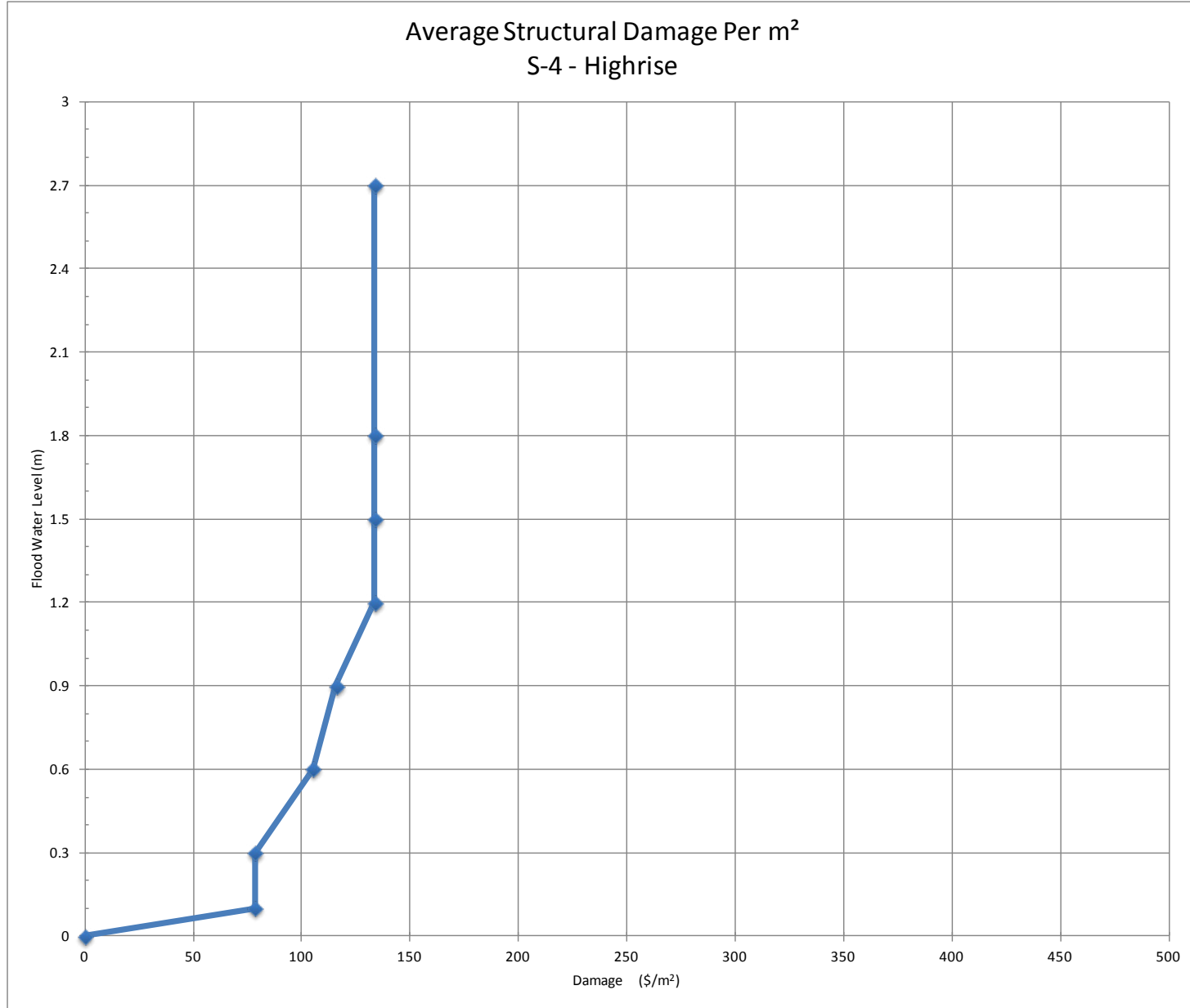
Flood Damage Study

Commercial (High-Rise Residential/Office)

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
Parkade (Per Level)	<ul style="list-style-type: none"> Remove and replace or rebuild Mechanical System equipment. Clean and sanitize all structural components after demolition is completed. Clean all sumps, floor drains and backflow preventers. Implement structural drying. Paint all components required after cleaning and drying is completed. Remove and replace all doors & hardware. 					
Note	Parkade restoration is calculated at \$215/m2 (\$20/ft2) based on floor area per level.	750	m ²	\$215	\$161,250	
Main Level						
0 – 0.1	<ul style="list-style-type: none"> Remove existing flooring. Clean and prepare slab. Install new flooring. Remove existing carpet. Clean and prepare slab. Install new carpeting. Remove and replace baseboards. Remove and replace all drywall to walls & ceilings. Remove and replace all poly vapour barrier. Remove and replace all insulation. Remove and replace all doors & hardware. Remove and replace all wood casings and door jambs. Remove and replace all kitchen cabinets and counter tops. Remove, clean and re-install bathroom toilet, sink and tub. 	50	m ²	\$65	\$3,250	
		50	m ²	\$90	\$4,500	
		150	linear m	\$6	\$900	
		450	m ²	\$30	\$13,500	
		350	m ²	\$1	\$350	
		350	m ²	\$3	\$875	
		8	door	\$800	\$6,400	
		8	opening	\$100	\$800	
		1	kitchen	\$20,000	\$20,000	
		2	bathroom	\$500	\$1,000	

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
Corridors, Amenity Areas, Lobby, Office, Stairs & Service Rooms:	<ul style="list-style-type: none"> Average level of finish. Add 30% to level of damage in typical unit. As denoted by *. 					
Grand Total						\$100,275

Non-Residential Structural Damage Curves



Summary of Specifications for Typical Building – Commercial (Institutional)

Structure Poured concrete, foundation, crawl space, columns and structural floor slabs including steel beams and joists with load bearing masonry walls.

Ext. Cladding

Walls:

- Metal cladding on concrete block.
- Split faced block on concrete block.
- Manufactured stone on concrete block.
- Metal cladding on steel studs.
- Split faced block on steel studs.
- Composite aluminum panels on steel studs.

Windows: -Aluminum framed sealed double glazed window unit.

Interior Finishes

Crawl Space:

Floor: -50mm sand bed on 6 mil poly vapour barrier.

Walls: -Poured concrete – unfinished.

Doors: -Steel access hatches with steel frames.

Ceiling: -Exposed structure.

Main Floor:

Floor:

- Ceramic tile.
- Carpet.
- Linoleum.
- Hardwood.
- Concrete – finished & unfinished.

Base:

- Rubber.
- Wood.
- Ceramic tile.
- Carpet.

Walls:

- Ceramic tile.
- Stone veneer.
- Wood veneer.
- Drywall painted.
- P-Lam panel.

Doors:

- Steel with pressed steel frame.
- Hollow metal with pressed steel frame.
- Solid core wood pressed steel frame.
- Aluminum with aluminum frame.

Ceiling:

- Drywall painted.
- Concrete painted.
- Exposed structure.
- T-bar system – acoustic.

Insulation: -Batt insulation.

Millwork: Plywood body, solid wood doors and drawers, P-Lam counters.

Washrooms: Full height tile to all walls.

Note: -Where two or more materials are shown, unit costs have been averaged.

Flood Damage Study

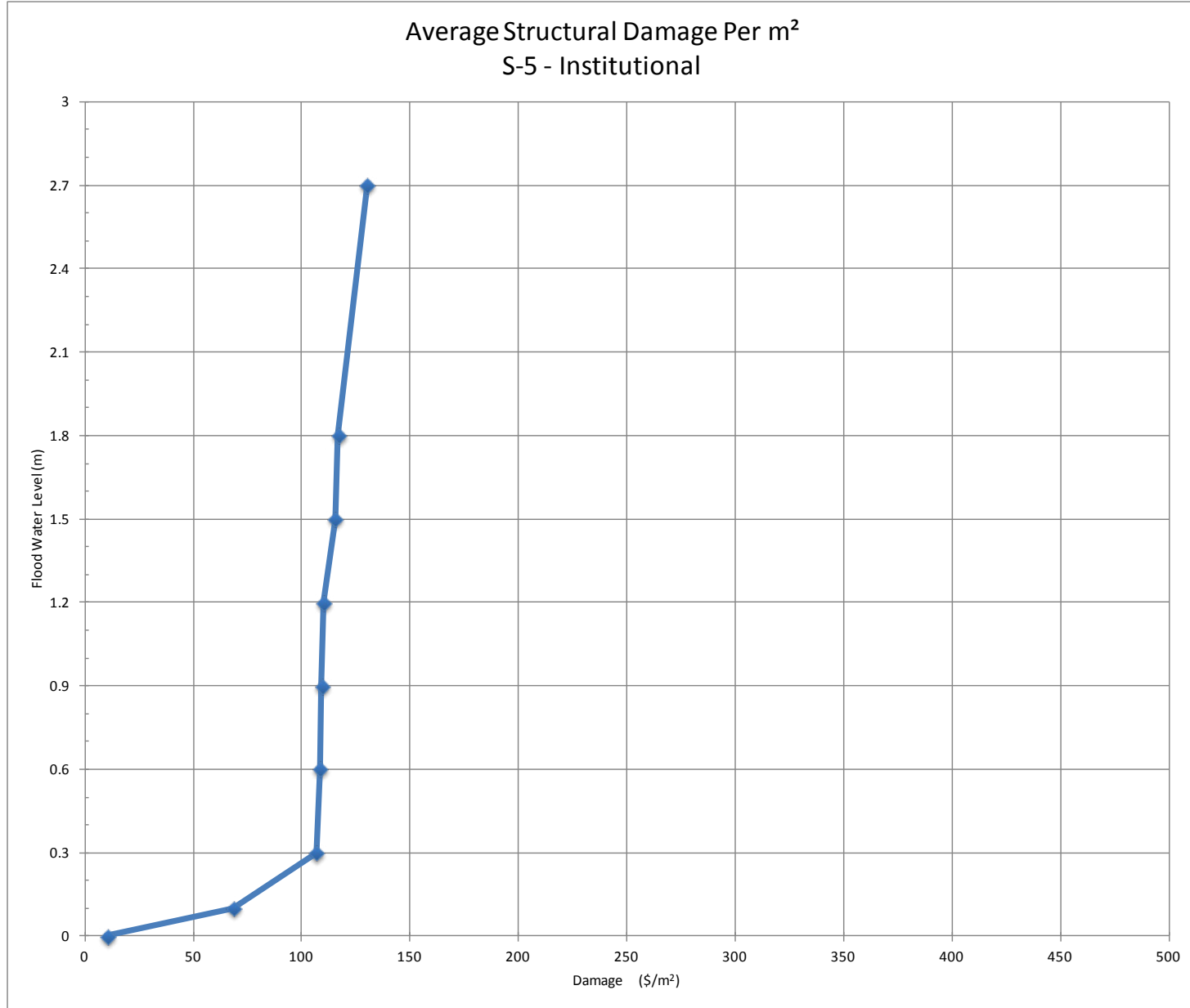
Commercial (Institutional)

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
Crawl Space						
0 – 0.1	<ul style="list-style-type: none"> • Clean and sanitize all Mechanical piping and ductwork. • Clean and sanitize all structural components. • Clean all sumps, floor drains and backflow preventers. • Implement structural drying. 	3983	m ²	\$10	\$39,830	\$39,830
Main Floor						
0 – 0.1	<ul style="list-style-type: none"> • Remove existing flooring. Clean and prepare slab. Install new flooring. • Remove existing carpet. Clean and prepare slab. Install new carpeting. • Remove existing wood flooring. Clean and prepare slab. Install new wood flooring. • Remove and replace all baseboard materials. • Clean and sanitize all structural components after demolition is completed. • Clean and sanitize all exterior building finishes. • Implement structural drying. 	1465	m ²	\$65	\$95,225	
		568	m ²	\$90	\$51,120	
		486	m ²	\$140	\$68,040	
		1000	linear m	\$6	\$6,000	
		36	hour	\$125	\$4,500	
		36	hour	\$125	\$4,500	
		40	hour	\$75	\$3,000	
						\$232,385
0.3	<ul style="list-style-type: none"> • Remove and replace drywall 150mm above soak line. • Remove and replace Interior insulation 150mm above soak line. 	107	m ²	\$30	\$3,210	
		107	m ²	\$3	\$268	

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
	• Remove and replace all wood door slabs & hardware.	60	door	\$500	\$30,000	\$152,478
	• Remove, clean and re-install washroom fixtures.	14	washroom	\$1,500	\$21,000	
	• Remove and replace washroom Millwork.	14	cabinet	\$750	\$10,500	
	• Remove and replace all Millwork.	2500	m ²	\$35	\$87,500	
0.6	• Remove and replace drywall 150mm above soak line.	107	m ²	\$30	\$3,210	\$6,478
	• Remove and replace insulation 150mm above soak line.	107	m ²	\$3	\$268	
	• Remove and replace electrical outlets and check wiring.	40	hour	\$75	\$3,000	
0.9	• Remove and replace drywall 150mm above soak line.	107	m ²	\$30	\$3,210	\$3,478
	• Remove and replace insulation 150mm above soak line.	107	m ²	\$3	\$268	
1.2	• Remove and replace drywall 150mm above soak line.	107	m ²	\$30	\$3,210	\$3,478
	• Remove and replace insulation 150mm above soak line.	107	m ²	\$3	\$268	
1.5	• Remove and replace drywall 150mm above soak line.	107	m ²	\$30	\$3,210	\$3,478
	• Remove and replace insulation 150mm above soak line.	107	m ²	\$3	\$268	
	• Remove and replace electrical outlets switches.	80	hour	\$75	\$6,000	

Datum	Description of Restoration	Cost to Repair				Cumulative Total
		No. of Units	Unit	\$/Unit	Cost	
1.8 – 2.4	<ul style="list-style-type: none"> Remove and replace electrical service panels. 	8	panel	\$1,500	\$12,000	\$21,478
	<ul style="list-style-type: none"> Remove and replace drywall to full height. Remove and replace insulation to full height. 	150	m ²	\$30	\$4,500	
		150	m ²	\$3	\$375	
2.7 & Above	<ul style="list-style-type: none"> Remove and replace ceiling system. Remove and replace electrical light fixtures. Caulk at exterior windows. 	375	m ²	\$30	\$11,250	\$53,750
		150	fixture	\$200	\$30,000	
		50	window	\$250	\$12,500	
Grand Total						\$518,228

Non-Residential Structural Damage Curves



Appendix I – Non-Residential Structural Damage Values

Non-Residential Structural Damage Values

Non-residential structures damages by interior elevation and classification, Calgary, \$/m2 floor area, 2014\$

Interior elevation		Non-residential structural classification				
		S1 - Office/Retail	S2 - Industrial/Warehouse	S3 - Hotel/Motel	S4 - Highrise	S5 - Institutional
Top of Level 1 (main) floor	0.0	\$0	\$0	\$0	\$0	\$10
	0.1	\$105	\$16	\$113	\$79	\$68
	0.3	\$127	\$21	\$212	\$79	\$107
	0.6	\$132	\$23	\$230	\$105	\$108
	0.9	\$135	\$23	\$242	\$116	\$109
	1.2	\$138	\$24	\$254	\$134	\$110
	1.5	\$155	\$30	\$284	\$134	\$115
	1.8	\$164	\$31	\$320	\$134	\$117
	2.7	\$185	\$38	\$391	\$134	\$130
Level 1 (main) ceiling	3.0	\$185	\$42	\$391	\$134	\$130

Damages exclude underground parking structures and landscape remediation

Appendix J – Selected References

Works Cited

- Acres Limited. (1968). *Guidelines for Analysis, Volume II Flood Damages*. Niagara Falls: Government of Canada and Ontario Joint Task Force on Water Conservation Projects in Southern Ontario.
- Aerts, J., Apel, H., Barredo, I., Bates, D., Feyen, L., Gericke, A., et al. (2012). Comparative flood damage model assessment: towards a European approach. *Natural Hazards and Earth System Sciences*, 3733-3752.
- Alberta Environment, City of Calgary. (1987). *Floodplain Management Plan for the Elbow River within the City of Calgary*. Edmonton: Alberta Environment.
- AMEC Environment & Infrastructure. (2014). *Southern Alberta Flood Recovery Task Force: Flood Mitigation Measures for the Bow River, Elbow River and Oldman River Basins - Volume 1 - Summary Recommendations Report*. Calgary: Southern Alberta Flood Recovery Task Force.
- AMEC Environment and Infrastructure. (2014). *Conceptual Design of the McLean Creek Flood Storage Site*. Edmonton: Southern Alberta Flood Recovery Task Force.
- AMEC Environment and Infrastructure. (2014). *Conceptual Design of the Springbank Off-Stream Flood Storage Site*. Calgary: Southern Alberta Flood Recovery Task Force.
- Anderson, E., & Ltd., C. B. (Unknown Year). *Economic Modeling of Floods: Calculating a B/C/ Ratio for Hazard Mitigation Grants*. (E. Anderson, & C. B. Ltd., Performers).
- Association of State FloodPlain Managers. (2007). *Use of Benefit/Cost Analysis for FEMA Programs*. Unknown City: Association of State FloodPlain Managers.
- Book, A. N., & Princic, R. (1975). *Estimating Flood Damages in the Fraser River Basin*. Vancouver: Environment Canada - Inland Waters Directorate - Pacific and Yukon Region.
- Booyesen, H., Viljoen, M., & Villiers, G. (1999). Methodology for the Calculation of Industrial Flood Damage and its Application to an Industry in Vereeniging. *WaterSA* , 41-46.
- Bubeck, P., Moel, H., Bouwer, L., & Aerts, J. (2011). How Reliable are Projections of Future Flood Damage? *Natural Hazards and Earth System Science*, 3293-3306.
- Chang, L., Kang, J., & Su, M. (2009). Industrial and Commercial Depth-Damage Curve Assessment. *WSEAS Transactions on Environment and Development* , 199-208.
- Chatterton, J., Green, C., Johnson, C., Morris, J., Penning-Rowsell, E., Tapsell, S., et al. (2005). *The Benefits of Flood and Coastal Risk Management: A Handbook of Assessment Techniques*. London: Middlesex University Press.
- City of Calgary. (2013). *Calgary & Region Economic Outlook*. Calgary: City of Calgary.
- Cowdin, S., & Leep, K. (Unknown Year). *Using HAZUS for a Statewide Flood Risk Assessment*. (S. & Cowdin, Performer).
- Davidge, D., Helsten, M., Simm, P., & Wood, M. (2005, June 8). *UTRCA Flood Damage Assessment*. (D. H. Davidge, Performer) Waterloo, Ontario, Canada.
- Davis, S. (1993). *Guidelines to Estimating Existing and Future Residential Content Values*. Ft. Belvoir: U.S. Army Corps of Engineers: Institute for Water Resources.
- Department of Homeland Security - Federal Emergency Management Agency. (2009). *Hazus-MH: Flood Model Technical Manual*. Unknown City: Department of Homeland Security.

- European Commission. (2003). *Best Practices in Flood Prevention, Protection and Mitigation*. Unknown City: European Commission.
- FEMA. (2005). *Effects of Long and Short Duration Flooding on Building Materials*. Unknown City: FEMA.
- Flores, P. J. (Unknown Year). *Development of FEMA Flood Loss Estimation Methodology*. (P. J. Flores, Performer).
- Fock, A. (2012, April 16). *2012 Central Valley Flood Protection Plan: Flood Damage Evaluation*. (A. Fock, Performer).
- Government of Alberta. (2013). *Budget 2013: First Quarter Fiscal Update and Economic Statement*. Edmonton: Government of Alberta.
- Government of Alberta: Municipal Affairs. (2013). *2013-1991 Municipal Affairs Population List*. Edmonton: Government of Alberta: Municipal Affairs.
- Hatch Mott MacDonald. (2014). *City of Calgary Glenmore Reservoir Diversion Feasibility Study*. Calgary: City of Calgary.
- Helsten, M., & Davidge, D. (2005). *Flood Damage Estimation in the Upper Thames River Watershed CFCAS project: Assessment of Water Resources Risk and Vulnerability to Changing Climatic Conditions - Project Report VII*. Waterloo: Upper Thames River Conservation Authority.
- Howe, C. H. (1971). *Benefit-Cost Analysis for Water System Planning*. Unknown City: American Geographical Union.
- IBI Group. (1993). *City of Calgary Flood Damage Assessment*. Edmonton: Alberta Environmental Protection.
- IBI Group. (1997). *High River Flood Damage Reduction Study: Appendices B & C*. Edmonton: Alberta Environmental Protection: Natural Resources Service.
- IBI Group. (1993). *Inglewood Floodplain Management Study*. Edmonton: Alberta Environmental Protection.
- IBI Group. (1990). *Pembina River Valley Floodplain Management Study, Phase 1 - Feasibility Evaluation Non-Structural Alternatives, Final Report*. Calgary: IBI Group.
- IBI Group; Ecos Engineering Services Ltd. (1982). *Phase 2B - Flood Damage Estimates - Fort McMurray Flood Damage Reduction Program - Technical Report*. Fort McMurray: Alberta Environment; City of Fort McMurray.
- J. N. MacKenzie Engineering Ltd. (1987). *Bragg Creek Floodplain Management Study*. Calgary: Alberta Environment.
- James, L. (1971). *Economics of Water Resources Planning*. Unknown City: McGraw-Hill.
- James, L. (1975). *Integration of Hydrologic, Economic, Ecological, Social, and Well-Being Factors in Planning Flood Control Measures for Urban Streams*. Unknown City: Unknown Publisher.
- Kates, R. (Unknown Year). *Industrial Flood Losses: Damage Estimation in the Lehigh Valley*. Chicago: University of Chicago Press.
- KGS. (2000). *Red River Basing Stage-Damage Curves Update and Preparation of Flood Damage Maps*. Unknown City: KGS.

- McBean, E., Fortin, M., & Gorrie, J. (1986). A Critical Analysis of Residential Flood Damage Estimation Curves. *Canadian Journal of Civil Engineering*, 86-94.
- Mehrdadi, N., Mohammadi, S., & Nazariha, M. (2014). Flood damage estimate (quantity), using HEC-FDA model - Case study: the Neka river. *Proceedia Engineering*, 1173-1182.
- Merez, B., & Thielen, A. (2009). Flood Risk Curves and Uncertainty Bounds. *Natural Hazards*, 437-458.
- Messner, F. (2007). *Evaluating Flood Damages: Guidance and Recommendations on Principles and Methods*. Unknown City: Unknown Publisher.
- Moel, H., & Aerts, J. (2011). Effect of uncertainty in land use, damage models and inundation depth on flood damage estimates. *Natural Hazards*, 407-425.
- Moel, H., & Aerts, J. (2014). Effect of Uncertainty in Land Use, Damage Models and Inundation Depth on Flood Damage Estimates. *Natural Hazards*, 407-425.
- Nascimento, N. (2006). Flood-damage curves: Methodological development for the Brazilian context. *Water Practice and Technology*, Unknown Pages.
- Nichols and Associates Ltd. (1979). *Economic Analysis of Fort McMurray Flood Abatement Measures*. Fort McMurray: Fort McMurray Technical Committee on Flood Abatement.
- Paragon Engineering Ltd. (1985). *Development of Flood Depth-Damage Curves for Residential Homes in Ontario: Volume 1 - Technical Report*. Ottawa: Environment of Canada.
- Paragon Engineering Ltd. (1986). *Development of Flood Depth-Damage Curves for Residential Homes in Ontario: Volume 2 - Computer Software Documentation*. Ottawa: Environment Canada.
- Paragon Engineering Ltd. (1984). *Flood Damages: Volume 1 - A Review of Estimation Techniques*. Kitchener: Paragon Engineering Ltd.
- SCARM Report 73. (2000). *Floodplain Management in Australia: best practice principles and guidelines*. Unknown City: CSIRO Publishing.
- Shawcross, S., & Ribeiro, A. (1988). *Athabasca River Basin Planning Program, Urban Flood Damage Reduction Component*. Calgary: IBI Group; Ecos Garatech Associates Ltd.
- Shawcross, S., & Ribeiro, A. (1982). *Fort McMurray Flood Damage Reduction Program, Phase 2B, Flood Damage Estimates*. Calgary: IBI Group; Ecos Garatech Associates Ltd.
- Shawcross, S., & Ribeiro, A. (1983). *Fort McMurray Flood Damage Reduction Program, Phase 2B, Preliminary Appraisal of Alternatives*. Calgary: IBI Group; Ecos Garatech Associates Ltd.
- Shawcross, S., & Ribeiro, A. (1985). The development of residential stage-damage curves for application in Western Canada. *Flood Hazard Management in Government and the Private Sector: Proceedings of the Ninth Annual Conference of State Floodplain Managers* (pp. 100-105). Unknown City: Unknown Publisher.
- Southern Alberta Disaster Recovery Program. (2013). *Ongoing Project Estimate Tracking - All Municipalities*. Calgary: Southern Alberta Disaster Recovery Program.
- State of California - The Natural Resources Agency - Department of Water Resources. (2012). *2012 Central Valley Flood Protection Plan: Attachment 8F - Flood Damage Analysis*. Unknown City: Central Valley Flood Management Planning Program.
- State of California Department of Water Resources. (2008). *Flood Rapid Assessment Model (F-RAM) Development*. Los Angeles: State of California: The Resources Agency.

Todorov, N., Todorov, M., & Todorov, N. (2013). Hazus: A Standardized Methodology for Flood Risk Assessment in Canada. *Canadian Water Resources Journal*, 223-231.

U.S Department of the Interior. (1970). *A Guide to Using Interest Factors in Economic Analysis of Water Projects*. Unknown City: Bureau of Reclamation.

U.S. Army Corps of Engineers: Engineer Institute for Water Resources. (1985). *Business Depth-Damage Analysis Procedures*. Unknown City: U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers: Institute for Water Resources. (1992). *Catalog of Residential Depth-Damage Functions*. Unknown City: U.S. Army Corps of Engineers: Institute for Water Resources.

U.S. Army Corps of Engineers: Institute for Water Resources. (2013). *Flood Risk Management*. Unknown City: U.S. Army Corps of Engineers: Institute for Water Resources.

U.S. Army Corps of Engineers: New Orleans District. (2006). *Depth-Damage Relationships for Structures, Contents, and Vehicles and Content-to-Structure Value Ratios (CSV) in Support of the Donaldsonville to the Gulf, Louisiana, Feasibility Study*. New Orleans: U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers; Rijkswaterstaat; MLIT; UK Environment Agency. (2011). *Flood Risk Management Approaches: As Being Practiced in Japan, Netherlands, United Kingdom and United States*. Unknown City: U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers; Rijkswaterstaat; MLIT; UK Environment Agency. (1997). Risk-Based Analysis for Flood Damage Reduction Studies. In U. A. Engineers, & H. E. Center, *Proceedings of a Hydrology & Hydraulics Workshop* (p. Unknown Pages). Pacific Grove: U.S. Army Corps of Engineers. U.S. Geological Survey. (1970). *Handbook for FIA Flood - Insurance Studies*. Unknown City: Federal Insurance Administration.

Veldhuis, J., & Clemens, F. (2010). Flood Risk Modeling Based on Tangible and Intangible Urban Flood Damage Quantification. *Water science and technology: a journal of the International Association on Water Pollution Research*, 189-195.

Vojinovic, Z., Ediriweera, J., & Fikiri, A. (2008). An approach to the model-based spatial assessment of damages caused by urban floods. *11th International Conference on Urban Drainage* (p. Unknown Pages). Edinburgh: Unknown Publisher.

White, G. (1964). *Choice of adjustment to floods*. Chicago: University of Chicago.

Zhai, G., Fukuzono, T., & Ikeda, S. (2005). Modeling Flood Damage: Case of Tokai Flood 2000. *Journal of the American Water Resources Association*, 77-92.