MULTIPLEX PROTOTYPE

UMBEL

Category 1: Second Storey Dwellings

Submitted to the District of Squamish for consideration in the Multiplex Design Competition on

October 28, 2024

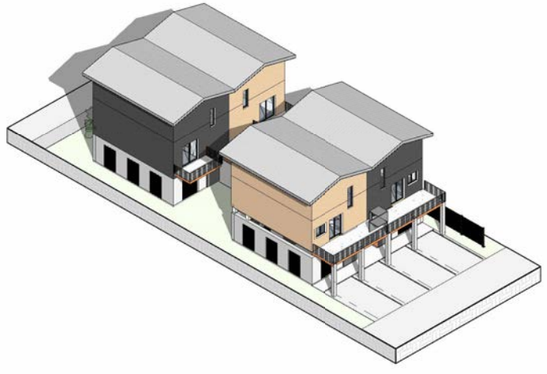
Prototype Umbel

Prototype Umbel offers an affordable and attractive option for R-1 zoned lots with a lane in areas with high Flood Construction Levels. The design prioritizes equity of ground level access for all units, and facilitates phased construction, allowing an owner to remain in their existing dwelling while redevelopment occurs. This approach aims to ensure replicability, control costs, and provide flexibility for individual needs. The intention behind the ability to phase the project is to allow an owner to stagger the construction of each duplex building, potentially inhabiting the existing home while the first duplex is under construction, and moving into the new building to allow for the construction of the second duplex.

As a Multiplex, this proposal seeks to preserve valuable greenspace in the middle and front of the lot while also providing functional and flexible spaces for residents of both dwellings to work, play, and live. The secure covered walkway addresses many privacy, overlook, and CPTED issues within the context of both the neighbourhood and the single lot, and facilitates equitable access to greenspace and entrances for inhabitants.

The primary objective of designing the assemblies for this project was to ensure resilience, particularly against severe flooding. Emphasis was placed on ensuring that assemblies at or below the Flood Construction Level (FCL) would endure flooding events without necessitating extensive remediation. These assemblies utilize non-organic materials for all structural assemblies below the FCL, and all critical building equipment has been strategically located above the FCL. This approach aims to minimize damage and maintain operational continuity, aligning with best practices for resilient infrastructure in flood-prone areas.

Isometric Massing Diagram



Project Information

Authority having jurisdiction:
District of Squamish

Proposed use(s):
Residential - Multiplex (R-1 Zoning)

Site area: 555 m^2 (5,972 sf)

Easements / ROWs: None

Lot coverage:
Proposed: 42.8%

Proposed height: 9.9m

Setbacks:
Front: 4.0m
Side: 1.2m
Rear: 7.3m
Between buildings: 6.7m

Building Code Summary

Applicable Building Code: BCBC 2024

Energy Efficiency Compliance Pathway:
BCBC 2024 Step Code 3 Equivalent

Construction Type: Combustible

3.2.4.19 - Visible Signal Devices and Visible Warning Systems: Visible signals proposed in addition to alarm signals

3.2.5.12 - Automatic Sprinkler System:
Sprinklers proposed (NFPA 13R)

9.10.15.5 - Construction of Exposing Building Faces of Houses:
Combustible cladding and soffits permitted

Bulletin B24-01-R indicates that Building Permits applied for before March 8 2027 will be exempt from the 2024 BC Building Code's adaptable dwelling requirements.

Area Summary

FAR by Level

Level	Area (SF)	Area (SM)
L1	596	55
L2	2,410	224
L3	2,410	224
Total FAR	5,415	503

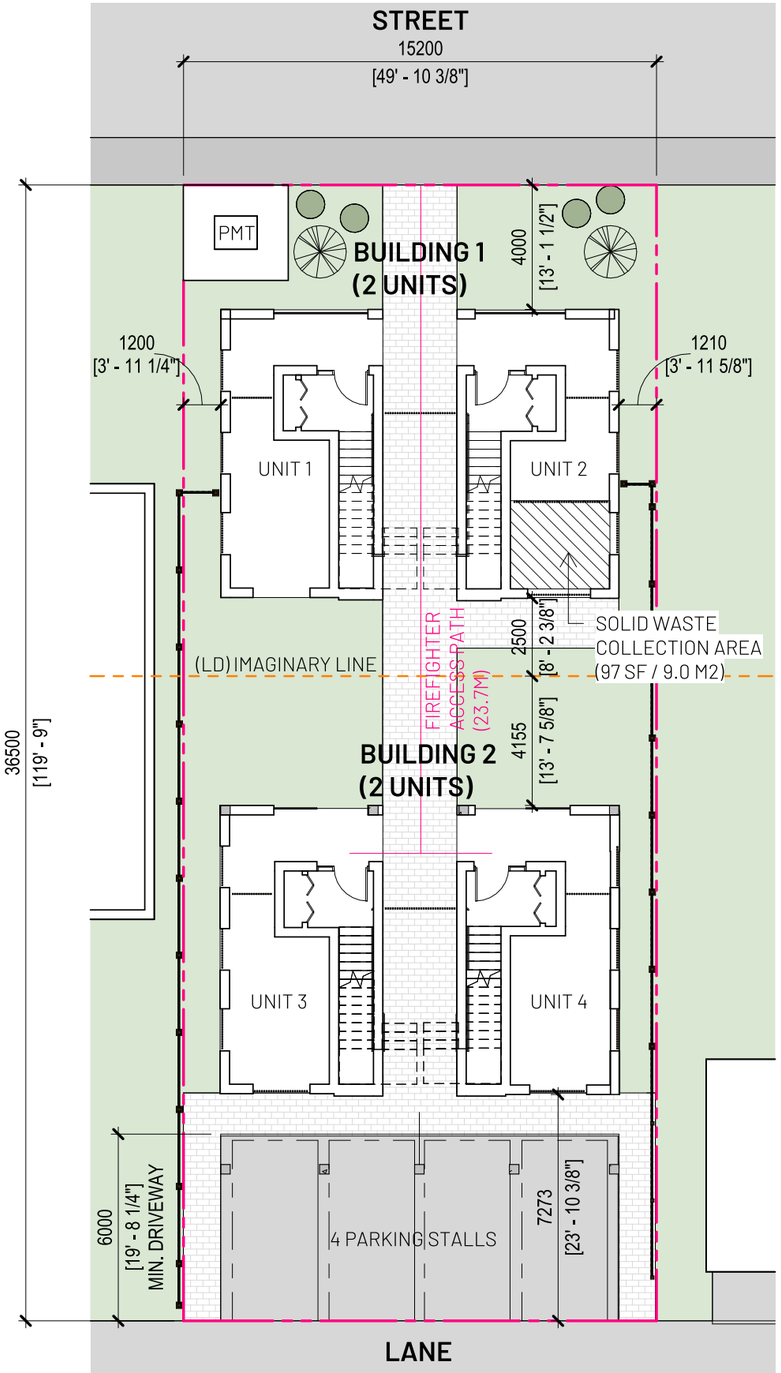
FAR by Unit

Unit No.	Area (SF)	Area (SM)	Unit Type
1	1,354	126	2 Bed + Den
2	1,354	126	2 Bed + Den
3	1,354	126	2 Bed + Den
4	1,354	126	2 Bed + Den
Total FAR	5,415	503	

Accessibility

The design of this Multiplex project provides accomodation for future modifications to the building to allow access to living spaces above grade. Adequate space and structure has been accomodated in the design to allow for a stair or porch lifts to be constructed to provide access above L1 in the future. The future-oriented site layout promotes flexibility in individual applications as they pertain to individual circumstances and lot configurations, and does not compromise the ability of applicants to reconfigure the design as needs change over time.

	EXPOSING BUILDING FACE	LD (m)	AREA (sf)	AREA (m2)	OPENINGS (sf)	% PERMITTED	% PROPOSED
BUILDING 1	NORTH	4.0	1224.2	113.7	167.3	16.0%	13.7%
	EAST	1.2	814.0	75.6	56.0	7.0%	6.9%
	WEST	1.2	814.0	75.6	56.0	7.0%	6.9%
	SOUTH (TO IMAGINARY LINE)	2.5	1067.3	99.2	106.1	10.0%	9.9%
BUILDING 2	NORTH (TO IMAGINARY LINE)	4.2	1224.2	113.7	167.3	16.0%	13.7%
	EAST	1.2	814.0	75.6	56.0	7.0%	6.9%
	WEST	1.2	814.0	75.6	56.0	7.0%	6.9%
	SOUTH	7.2	1067.3	99.2	106.1	10.0%	9.9%



1 Site Plan
1/16" = 1'-0"

Construction Cost

Hard Costs

Type	Area (sf)	Unit Cost ($/sf)	Cost ($)
Building (1)	5415	320	$1,732,800.00
Site Improvement		5%	$86,640.00
Subtotal			**$1,819,440.00**

Soft Costs

Permits, fees, etc.		25%	$454,860.00
Consultants		20%	$363,888.00
Loan Interest		5%	$90,972.00
Contingency		5%	$90,972.00
Subtotal			**$1,000,692.00**
GST		5%	$141,006.60
Total Project Budget			**$2,961,138.60**

Notes:
The estimated total cost of construction is forecast using available sources and generalized market assumptions and should not be relied upon for construction purposes.

Affordability

Access to affordable and secure housing in the Lower Mainland and Squamish is a crisis being faced by current and future generations, impacting their ability to work, live, play, and thrive in their local community. Innovative responses to the housing crisis, such as standardized housing designs, are anticipated to contribute to security of affordable housing by reducing up-front housing costs through delivery of a streamlined permitting process and efficient construction practices.

Notes:
Design development drawings as provided are for general illustration of form and character only. Detailed Building Code analysis will be required for individual applications at the Building Permit Application phase.

Local materials and trades

The materials and assemblies chosen for this project are readily available from local suppliers and do not necessitate highly-specialized trades for installation or maintenance. This ensures that a larger pool of experienced trades and material suppliers are available to support construction activity, which generally has a positive impact on construction costs.

Standard “kit of parts”

This project prioritizes inclusivity and replicability. It uses locally available materials and standardized building components to enhance constructability and control costs effectively. For example, the project was designed using conventional sizes of roof trusses and floor joists, deliberately steering clear of intricate assemblies, large spans, cantilevers, or complicated geometry requiring advanced techniques or additional structural elements.

Durability

The exceptional durability of the proposed assemblies at or below the FCL are intended to withstand the worst-case flooding scenarios within the District of Squamish. Resilience, crucial for enduring disasters and heavy wear, is integral to both affordability and sustainability. One of the design goals of this project is to facilitate a return to normal operation as quickly and cheaply as possible following a flood or fire event by designing for material and structural resiliancy.

Innovative Design

The design concept for this Multiplex project emphasizes the integration of cutting-edge building science principles in a manner that is both simple to construct and easily replicable. The architectural advancements primarily prioritize resilience and sustainability, while also placing significant emphasis on aesthetics and functionality to cater to a wide range of household compositions and requirements, thereby promoting inclusivity.

The ability to phase the buildings is a way of addressing affordability and flexibility of individual circumstances within the design. By facilitating the existing dwelling units to remain on site while a duplex is being added to the other half of the site encourages redevelopment on a smaller more inclusive scale which doesn't require residents to vacate their dwellings to redevelop their site.

The FCL was a critical design component of this project. The unconditioned open space at L1 provides usable space for each resident at ground level which can be used for many uses and activities which do not contravene the Flood Plain Management Bylaw. All critical equipment required for occupancy is located above FCL. All circuits and junction boxes are located at or above FCL.
Metal siding and roof are flood and fire resistant, while also representing a low carbon option for high durability materials. Many of these metal components can also be comprised of recycled materials, further reducing embodied carbon. Standing seam roof is inherently solar photovoltaic ready. Metal roof has high albedo, reducing heat island effect. External insulation strategy allows for flexibility in individual design applications. The proposed wall assemblies could accommodate higher levels of thermal performance with minimal impact to setbacks or layout. Lastly, this design includes sliding metal screens intended to act as exterior window shades for all windows. Exterior shades are much more effective at reducing solar heat gain than window blinds, and are able to protect the building exterior from extreme weather events such as hail or debris in strong wind.

Metal Lap Siding
[MS0a, MS0b, MS0c]

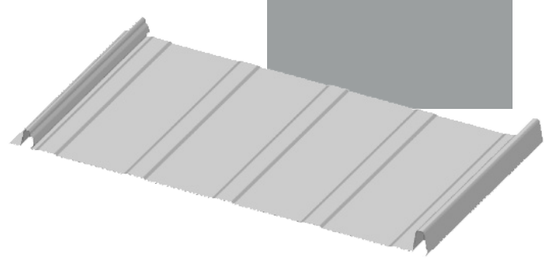
MS-1 - Black

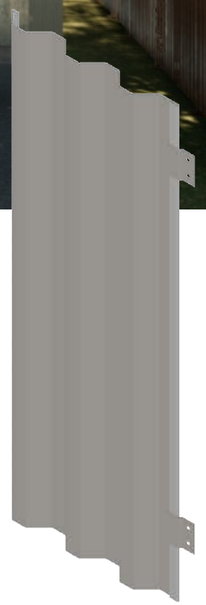
MS-2 - Western redcedar

MS-3 - Copper Penny

Standing Seam Metal Roofing
[RF1]

SSMR - Regent Grey





Corrugated Metal Panel
[C2a]

CMP- Charcoal

Sustainability and Resiliance

This Multiplex prototype has been designed with sustainability and resiliancy as core principles driving the design. In this project, we adopted the stance that the most sustainable path for a building subject to a potential future flooding event would be for as much of the original structure elements to be undamaged and reused as much as possible. Structural walls or floors which may have contact with flood water utilize non-organic and non-porous materials which are designed to dry passively.

In addition, this design prioritizes low embodied carbon materials and integrates products with minimal global warming potential into the proposed assemblies. Despite concrete's high embodied carbon footprint, the design rationale argues that its durability and resilience make it less impactful than materials requiring a complete rebuild after a flooding event.

Heating and Ventilation

The project plans to use electric baseboards for heating, with additional support from a ductless mini-split heat pump for winter heating and summer cooling. An Energy Recovery Ventilator (ERV) in the hallway bulkhead manages air changes per hour and humidity, without directly consuming carbon-intensive fuels during building operation.

Solar Energy

The standing seam metal roof, with its slightly reflective and high albedo surface, mitigates heat island impacts and reduces solar heat gain into the building. This type of roof is well-suited for installing photovoltaic cell arrays, as the raceway channels can be directly fastened to the standing seams above the roof deck surface. A vertical chase from the electrical panel to the roof will be accommodated in the design development phase.

Each window is equipped with a manual sliding exterior horizontal sunshade where possible. Accessed through the operable windows, exterior sunshades provide superior protection from solar height gain and provide a second layer of protection from adverse weather and climate conditions, such as hail, which are occurring more frequently than in the past.

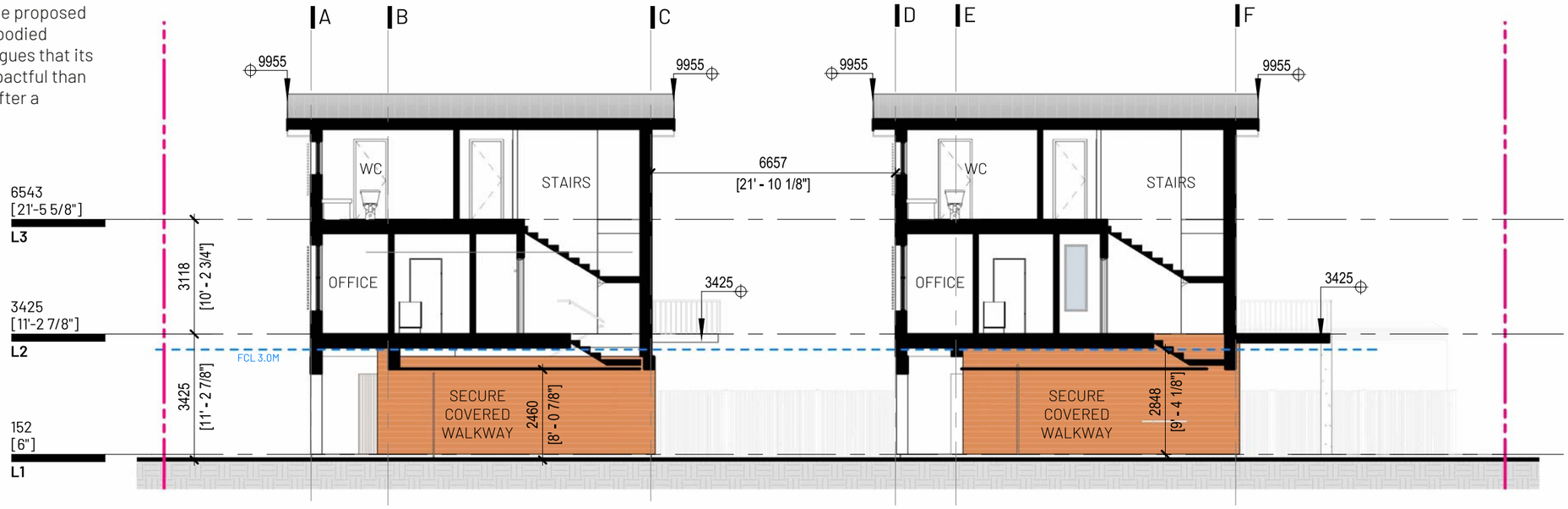


Table 9.36.2.6-B:

	Required (Effective)		Proposed (Effective)		
Assembly	**RSI**	**R**	**RSI**	**R**	**Reference (BCBC 2024)**
Ceiling below attic	6.91	39.23	7.79	44.23	9.36.2.6-B
Cathedral ceiling	4.67	28.50	5.02	28.50	9.36.2.6-B
Walls	2.78	15.78	4.11	25.42	9.36.2.6-B
Foundation walls	1.99	11.30	3.27	18.57	9.36.2.8-B
Floors over unheated space	4.67	26.52	5.88	33.43	9.36.2.8-B
Unheated floors	1.96	11.13	3.27	18.57	9.36.2.8-B

Embodied Carbon

The BC Energy Step Code presents designers the opportunity to address the operational carbon emissions over the lifetime of the building. This proposed design seeks to also minimize the embodied carbon of the project by ensuring that building elements are resilient and do not need to be rebuilt after a flood event. Assemblies have been designed to not only meet the current and future thermal requirements, but which utilize low embodied carbon materials wherever possible. For example, polyisocyanurate insulation was proposed over XPS due to the embodied carbon, however assemblies can easily be modified for individual applications as required.

Product	kg of C02e/m2
XPS (Legacy)	4937
Brick	4725
Fibre cement boards	1703
Steel siding	1422
XPS (New)	715
Mineral fibre (Rigid)	473
EPS	288
Polyisocyanurate	252
Fibreglass batt	154

Source: City of Nelson[3]

FireSmart Design

This proposal embraces principles from both FireSmart design and flood resiliency best practices. The proposed design incorporates standing metal seam roofing—a Class A fire retardant material with low flame spread—as well as Class A steel siding. Metal vents and flashing, recommended by FireSmart Canada, complement these choices. Decks, ramps, stairs, and overhangs are intentionally left open for simplified maintenance and combustible material removal. Furthermore, the site layout ensures combustible planting and tree canopies are kept at a safe distance from the building.

Thermal Performance

The project is designed to meet or even surpass the prescriptive requirements of the BC Building Code 2024 Part 9, as outlined in Section 9.36. Adopting a strategy of continuous exterior insulation enables future modifications to the insulation value of the walls by adjusting the amount and type of insulation within the wall cavity. This design flexibility empowers homeowners to enhance performance by adding to or replacing cavity insulation in the future, if desired.

Airtightness

The continuous exterior insulation strategy complements the attainment of a high-performance air tightness rating. Foil-faced polyisocyanurate insulation is particularly suited to this objective. In subsequent design phases, we will pursue an external air barrier strategy consistent with the BC Housing Illustrated Guide to Achieving Airtight Buildings and compliant with BCBC 2024 9.36.2.9.

FCL Level

In a flood event, the walls and floors at or below the Flood Control Level (FCL) are designed to withstand sustained exposure to water and facilitate passive drying following the flood event. The area shown as unconditioned open space is designed to be 40% open minimum and not be an impediment to flooding waters. This area is intended to comply with the Flood Plain Management Bylaw, and would not permit the storage of goods susceptible to damage by flood water below the FCL.

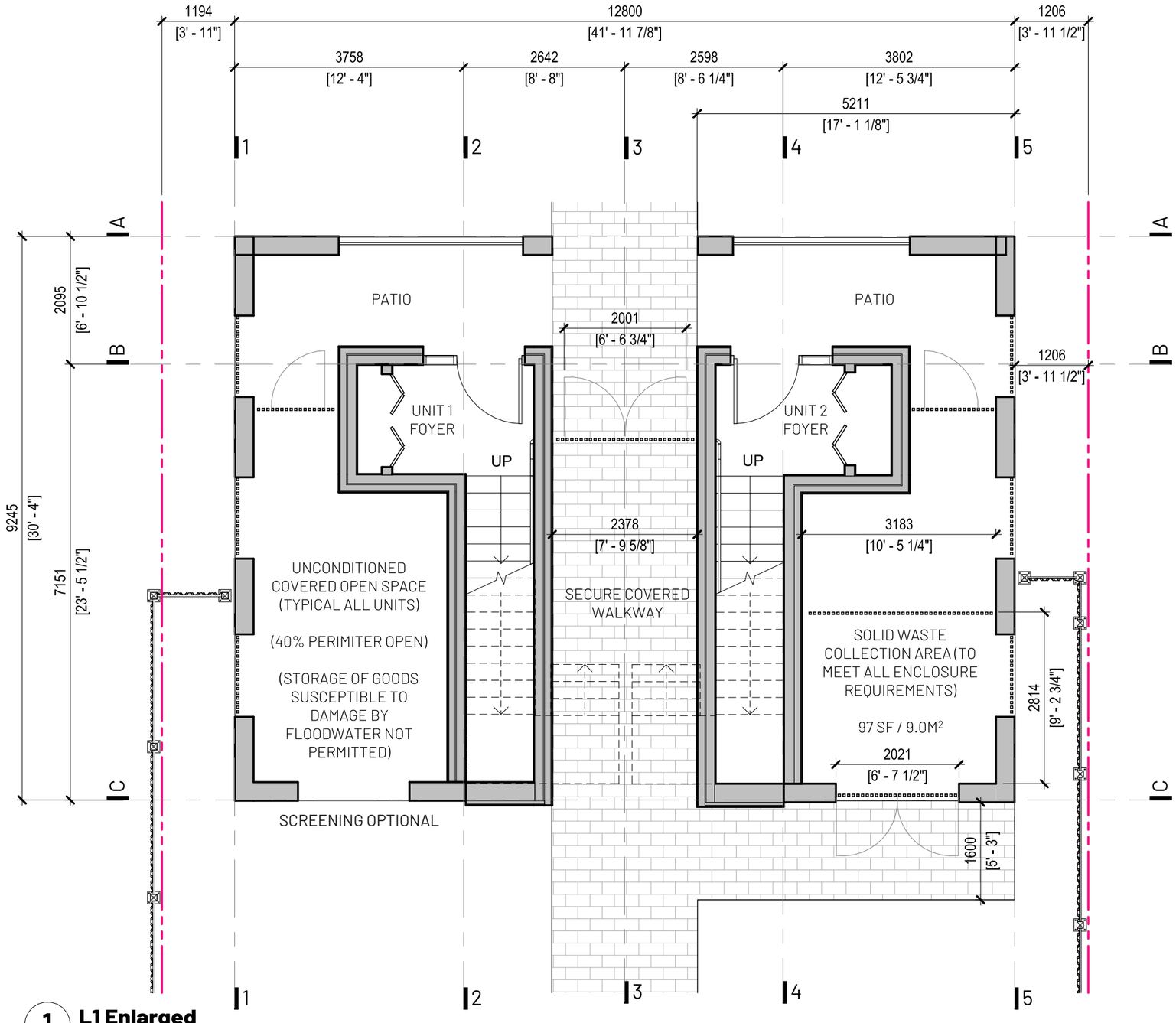
Stormwater Management

Permeable surfaces are proposed for all on-site walk and driveways where permitted.

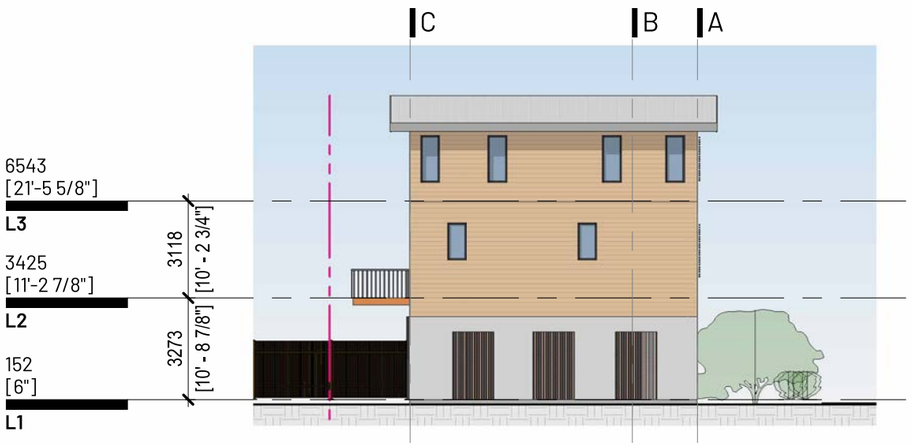
Sprinklers & Domestic Water

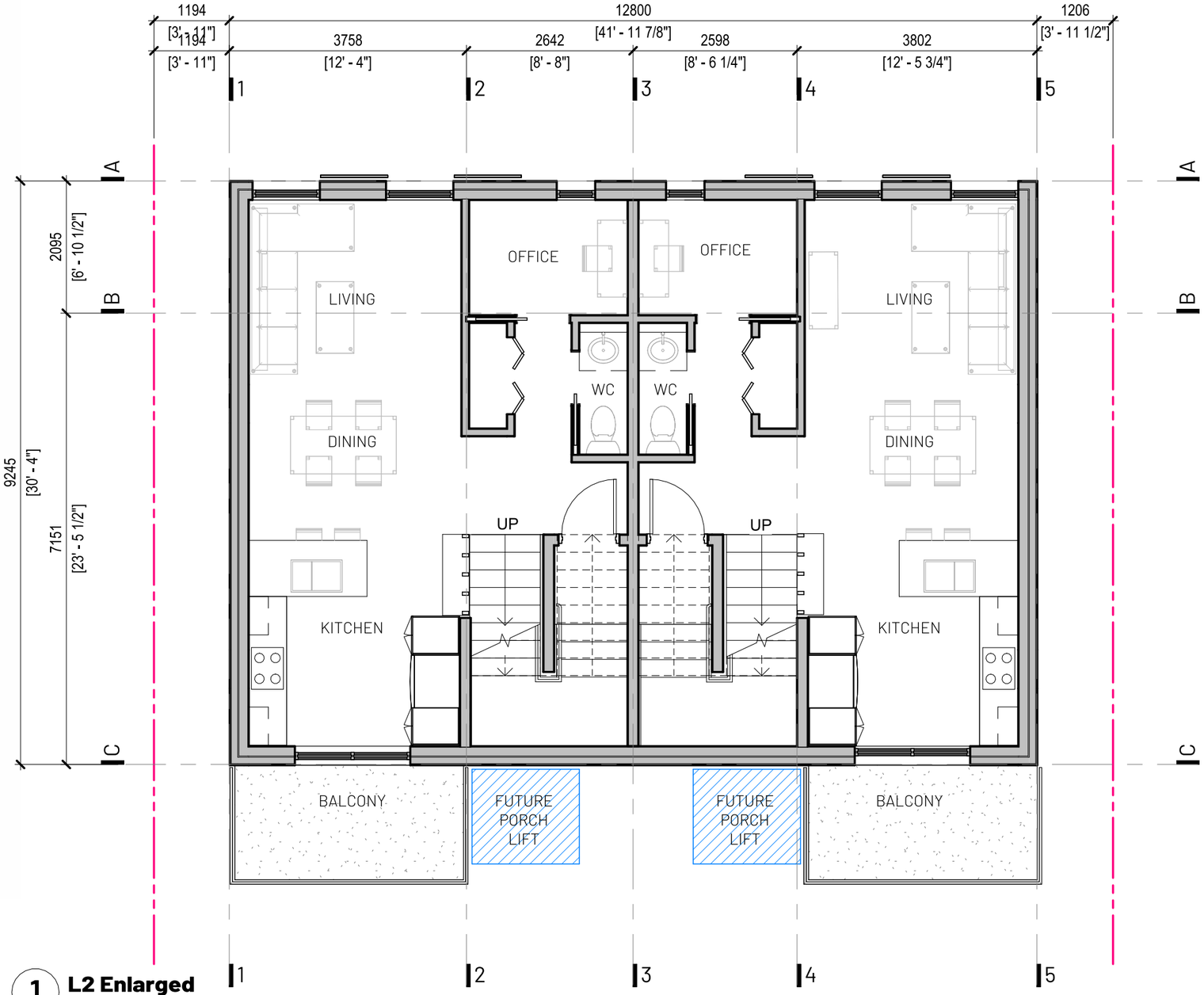
Domestic hot water is provided by a tankless water heater, located in the dining room millwork, and distributed through the half-height wall to the rest of the dwelling. All critical equipment servicing the operation of the dwelling is located above the FCL.

While sprinklers are generally not required for this type of building (depending upon local site conditions, according to BCBC 2024), the project includes provision for sprinklers and required mechanical equipment. Sprinklers are an important component to FireSmart buildings and provide substantial fire protection to inhabitants and adjacent structures at minimal initial cost.

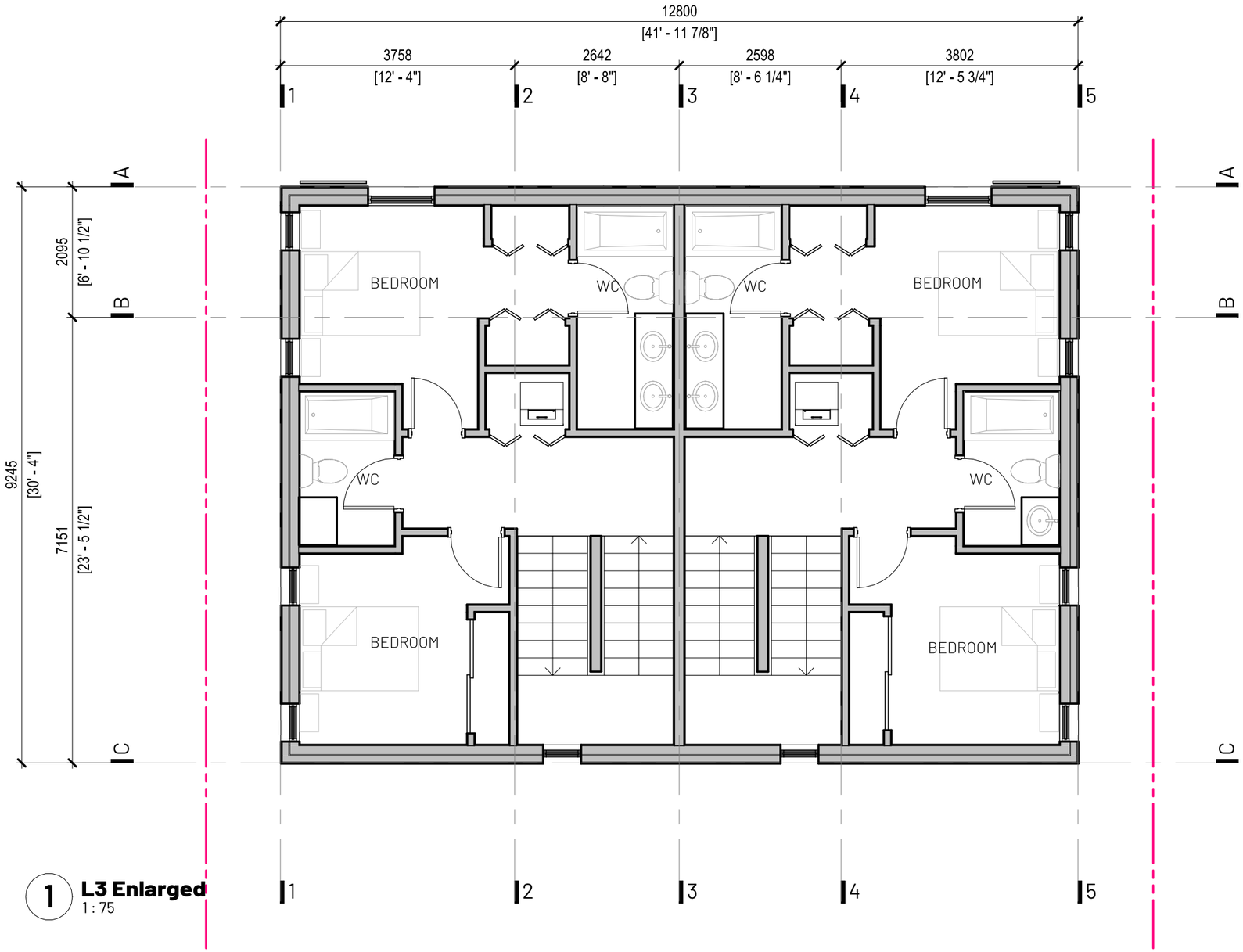


1 L1 Enlarged
1 : 75





1 L2 Enlarged
1 : 75



1 **L3 Enlarged**
1 : 75