1. Oblique view of the west and south elevations. The vertical western red cedar siding was factory pre-stained.

THE BLACK BARN PROJECT

A re-envisioning employs passive ideas and prefabrication

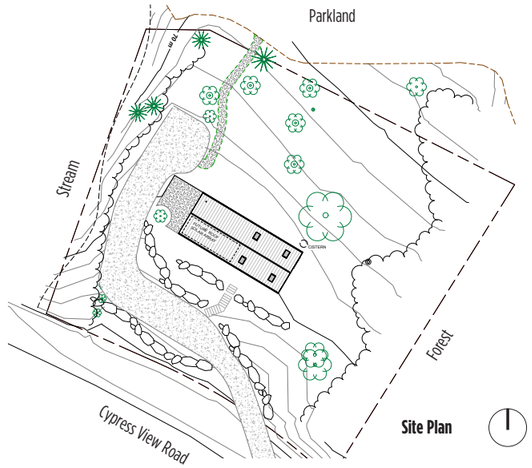
By Ralph Herzig

The Black Barn project on Salt Spring Island, BC was conceived as a prototype for energy-efficient, pre-fabricated custom homes in remote locations around the province.

Historically, Salt Spring Island provided food for Victoria and Lower Mainland Vancouver for close to 150 years. Known as the "fruit basket" of the islands, Salt Spring farms supplied large quantities of fruit and vegetables. Old apple orchards still dot the island and contain long lost varieties.

The typology of a typical barn building traces its roots to the oldest homestead found in Ruckle Provincial Park on the south end of the Island, which is still a working farm. The island's agricultural history provided the "patina" and backdrop to the 160 m^2, two-bedroom, two-bathroom holiday home that could serve as a temporary or permanent home to its owners.

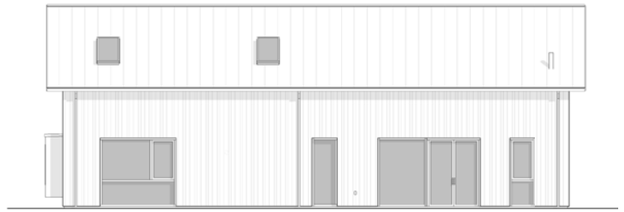
Careful studies of the sunlight conditions were made to select the site but also orient the building to optimize sunshine exposure throughout the year. While many locations on the site provide outstanding views, the one selected receives four hours of direct sunlight during the shortest day of the year.



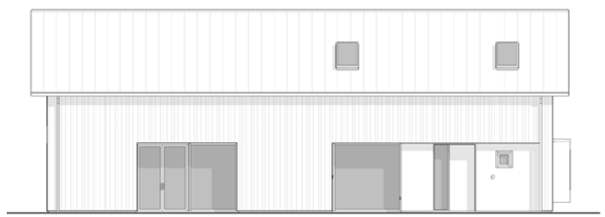
Site Plan

2. View along the north elevation. The long axis of the building maximizes the sunlight exposure.

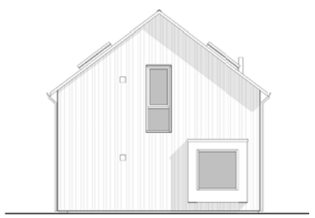
West



North



South



East

The building is located at an existing roughed-in building site that was completely overgrown. During the site preparation 20 truckloads of quarried stone were discovered, left there from earlier times. Half of the stones were used in new retaining walls and the rest traded for excavation work to be re-used on other construction sites.

The house is oriented to optimize natural ventilation, balance privacy and views, as well as daylight cycle conditions. Operable tilt & turn mezzanine and main floor windows let cross breezes from harbour side to mountain side (the short axis of building) and from southeast to northwest (the long axis of building) circulate through the house. A ceiling fan provides additional convection when needed.

An HRV system delivers 0.5 air cycles/hour and includes HEPA filters that can remove smoke particulates. When the house was first occupied (late summer 2020), the HRV system noticeably improved indoor air quality compared to the outside air affected by forest fires along the west coast of the continent.

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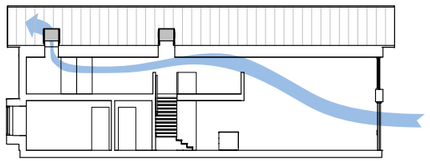
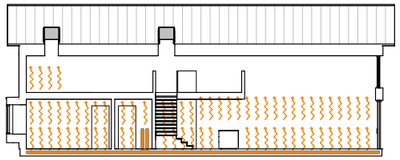
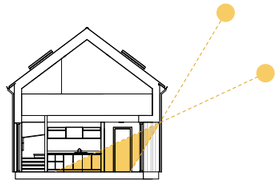
3. The prefabricated wall and roof panels and service wall assemblies provide R values of 32 and 47, respectively.



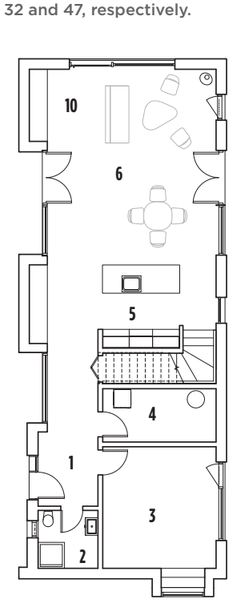
Cross-ventilation



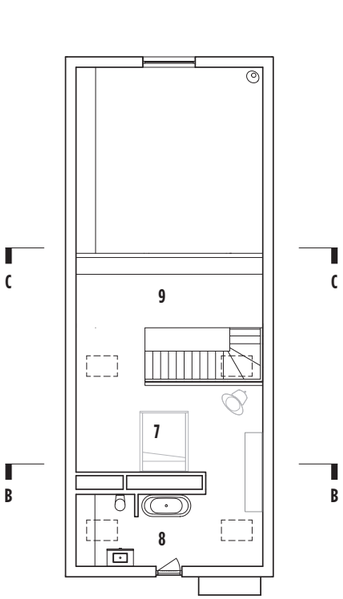
Radiant Floor Heating



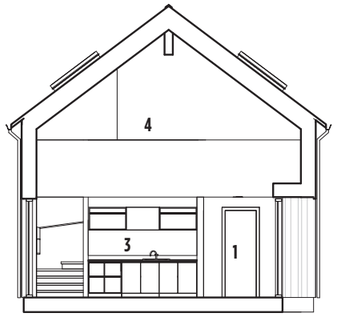
Sun Azimuths



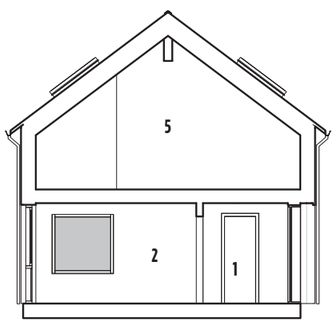
Ground Level



Mezzanine Level



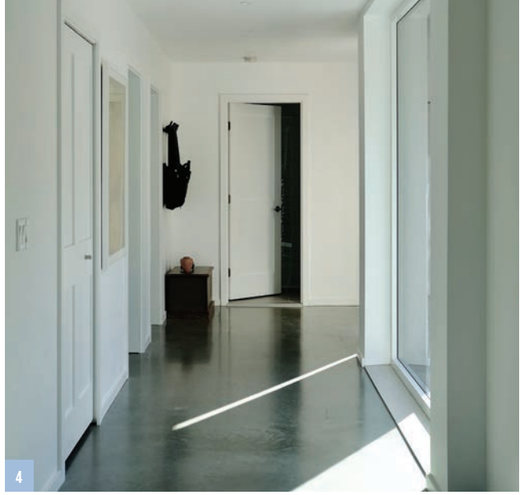
Section B-B



Section C-C

1. Main Entry
2. Washroom
3. Study / Bedroom
4. Mechanical
5. Kitchen
6. Living / Dining
7. Master Bedroom
8. Master Washroom
9. Study
10. Library

1. Main Entry
2. Study / Bedroom
3. Kitchen
4. Master Bedroom
5. Master Washroom



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4. The narrow footprint allows plenty of natural light throughout the interior. 5. Installing the in-floor warm air radiant heating system prior to the slab pour. 6. The master bathroom on the second-floor loft where a skylight admits additional natural light.

An important aspect of the building design was the choice of materials and finishes used. For example, the interior was painted using low-VOC Farrow and Ball paint. Wood stains and oils to finish wood elements included Osmo oils. The Douglas fir flooring on stairs and mezzanine areas was treated with lye and white oil which allow the wood to breath and is water repellent. This surface can be washed with a natural, water-based soap solution.

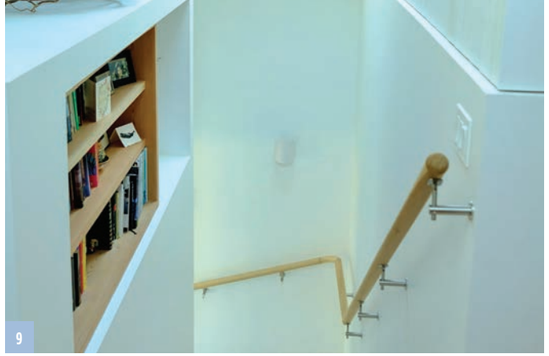
Floor-to-ceiling windows blur the boundaries between inside and out, and the building layout would allow the owners to occupy the ground floor if needed as they age. The lower floor bedroom and bathroom, with a low threshold walk-in shower, facilitate usability over multiple stages of life.

Passive heating principles include south-facing openings designed to maximize sunlight penetration in winter and reduce solar gain during the summer months. The significant thermal mass of the slab on grade foundation contributes to the moderation of temperature swings. Moreover, the slab contains an in-floor warm air heating system which, in effect, makes the slab act as heat battery with a slow, even release of heat.

The prefabricated wall and roof panels and service wall assemblies provide R values of 32 and 47, respectively, while the floor assembly is rated at R 34. The total energy consumption is 80 kWh/m^2/year.

The primary energy source for the building is electricity. The building utilizes LED lighting and provides natural light for all work areas thereby reducing the energy consumption needed for work and living. The anticipated installation of a grid-tied PV plant is supported by pre-installed conduits. Additional conduits have also been installed to allow for an electrical charging station. These anticipated next phase investments support the Salt Spring Island Climate Action plan and priorities.

The design-build strategy involved the use of several pre-fabricated building elements including: insulated wall and roof panels, floor elements, ICF foundation elements and pre-stained and cut exterior façade elements. The selection of these pre-fabricated components reduced the onsite installation time and also significantly reduced waste and the excess shipping of material to and from the island, an observation that did not go unnoticed by inspectors and installers. Wherever possible, onsite waste, such as packaging materials, was returned to the community recycling facility.



7. The living/dining area. Operable tilt & turn windows allow for cross-breeze ventilation. 8. The loft containing the study, master bedroom and bathroom has in-floor electric heating. 9. The stair leading from the loft to the kitchen.

From a material perspective the building used materials with an inherent longer service life and lower lifetime service needs. For example, the use of a metal roof instead of asphalt shingles; hard-wearing polished concrete flooring; and factory-applied wood penetrating stain with longer repaint cycle quality will result in less maintenance and replacement over time.

The Black Barn structure re-envisions the traditional barn building as a contemporary, highly efficient home that incorporates green strategies and flexibility for future expansions to the property.

Ralph Herzig is with Blank Design & Project Management Inc.

PROJECT CREDITS

Architect: Blank Design & Project Management Inc and GBD+ Associates in joint venture
Architectural Technology and Design: Parallel Group Operations Inc
Construction: Blank Design & Project Management Inc and Green Island Construction
Structural engineer: Equilibrium Consulting Inc
Consultant: BC Passive House
Mechanical: Legalett Inc
Electrical: Akerman Electric Ltd
Photos: Flat Earth Photography