PROJECT DESCRIPTION

An innovative fusion of beauty and efficiency, Westbay Passive House in West Vancouver sets a new precedent for net zero energy buildings across the globe. The contemporary home was designed by local architects and sets the bar for architectural design with a high-performance envelope and efficient systems. The home achieved a Passive House Plus certification, an Energuide Rating of 0 tonnes of Green House Gas, and a 0 GJ of energy consumption rating. Other unique attributes include the use of Cross-Laminated Timber (CLT) superstructure atop a concrete foundation, floor-to-ceiling glazing for uncompromised ocean views, and passive solar design through built and environmental shading. The mechanical system utilizes a high efficiency Energy Recovery Ventilator (ERV) which uses an integrated electric heat pump and hydronic coil to provide heating and cooling to the ventilation air ensuring optimum indoor air quality and thermal comfort throughout the entire home.

Strategic Decisions

Located in the heart of Metro Vancouver's luxury home market, the project introduced a sustainability-conscious design ethos to the area by creating a home that was both architecturally pleasing and passive certified.
Capturing the ocean view was critical to the design so triple-glazed thermally-broken glazing systems were used to minimize the heat loss and overhangs designed for passive shading.

The superstructure was built with prefabricated CLT panels which provided a very durable and robust building core. By prefabricating the components, the construction schedule was reduced by 2 months with a significant reduction in waste and an increase in structural embodied carbon.

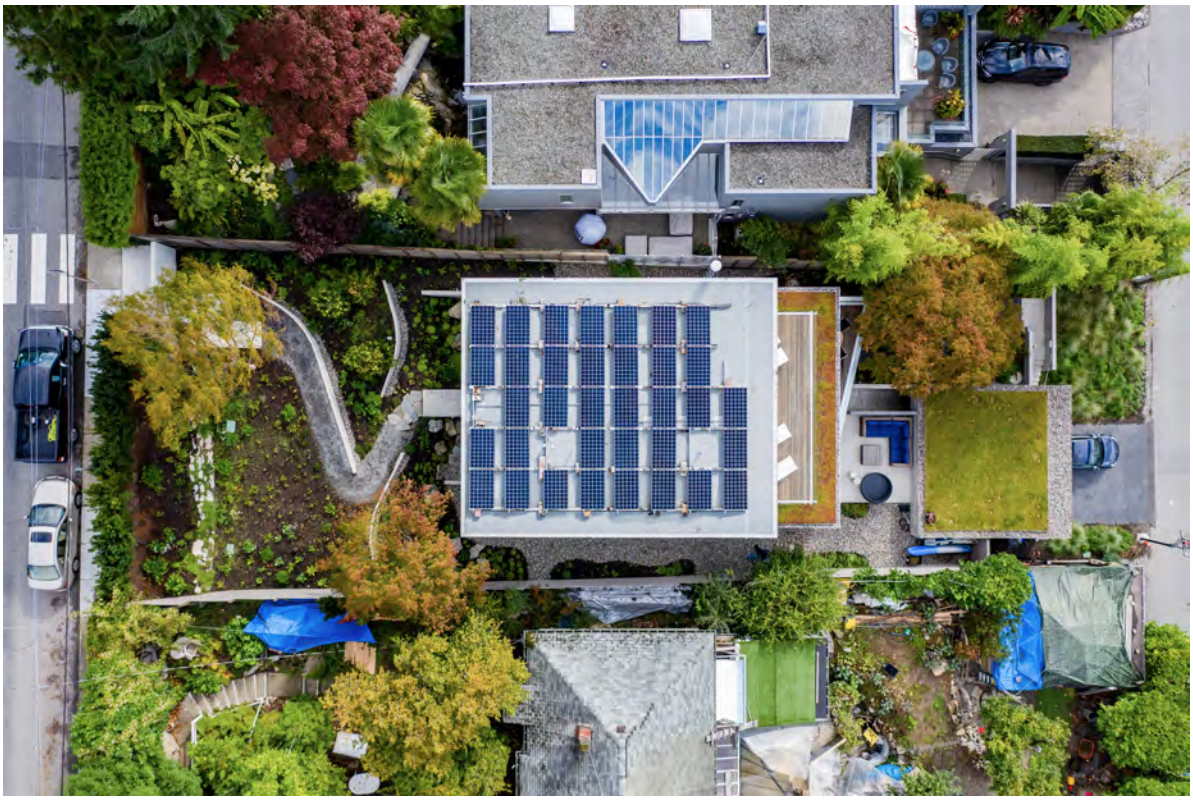
The active mechanical system consists of an ERV for ventilation and a heat pump hot water tank. The same small heat pump also feeds a heating and cooling coil on the ERV's supply lines and is able to provide a comfortable indoor environment for all occupants.

Community

The project team took a proactive role to educate the community, youth, municipal officials, tradespeople, and building professionals through a video series, seminars, open houses, and media interviews to help advance the *green* building movement. The District of West Vancouver has allowed additional FSR in high-efficiency homes based on a precedent setting variance from this project due to additional envelope thickness from extra insulation.

The home sits along a bus and bike route to the city and has dedicated storage for 6 bicycles as well as dedicated charging for two electric vehicles. With a low walkscore of 1, this affluent neighbourhood needs more examples of housing such as the Westbay Passive House where the sustainability is an affordable cost addition and owners are enabled to set the market trend. This home demonstrates that building to net zero is a modest 5% increase in cost.

Site Ecology



Thoughtful planting selection and hardscape choices were made throughout the steep site in order to cultivate a landscape of longevity and connectedness. Boomerang'd retaining walls were used in the backyard to stabilize the slope and provide room for several mixes of pollinator-loving perennials and native grasses to take root. The construction of these walls, along with work in the front yard was undertaken carefully in order to preserve 3 mature maple trees that add shade and privacy to the landscape. Plantings were carefully chosen to tie into the native ecologies of Vancouver and provide a wealth of different habitat and sustenance options for pollinators on-site. The planting continues from the ground plane to the built form, where the garage roof and balcony perimeters are planted with grass and sedum to soak up rainwater and reduce impermeable surfaces.

Light and Air

Natural light is brought into the home through strategically placed windows on all four facades including the basement suite which looks onto a sunken garden in lieu of a traditional window well. The beautiful waterfront views and ocean breeze can be brought in by opening the large sliding glass doors which works to cool the entire home on the warmest of days.

Balanced ventilation with energy recovery provides continuous filtered fresh air and ensure optimum indoor air quality. MERV 13 filters installed in the ERV system for protection against external pollutants. The unit provides up to 248 cfm of total supply air to the occupants. A monitoring device installed to track IAQ levels inside the home.

The recirculating range hood with carbon filters exhausts cooking odours and does not require make-up air which typically results in energy loss. An electric induction stove selected to reduce the use of fossil fuels and residual combustion fuel.

Wellness

Super-insulated walls provide the benefit of acoustic isolation from nearby train tracks outside creating an astonishingly quite indoor environment. The building sits on a sloped site encouraging an active lifestyle.

Solar shading was optimised and dynamic thermal modelling was done using CIBSE Thermal Analysis (TM52 & TM59) and supplemented with PHPP modelling results to ensure no overheating of the home.

A High-efficiency wood-burning fireplace was installed with heat exchangers and dampers creating hygge, warmth, and comfort without using gas or electricity. The green roof on all visible roof areas grounds the occupants in nature.

Water Conservation

Several water conservation strategies were used including:

- A waterless urinal installed in the shared kid's bathroom
- Water sensors installed throughout the home so the master valve can be shut quickly to avoid losing water and damaging the home in the event of a leak
- Condensing dryer collects the water from laundry to be re-used for cleaning.
- Low-flow plumbing fixtures used throughout
- 72" Drainwater heat recovery tied to showers and the dishwasher.
- Drought-tolerant native planting
- Green roofs to reduce stormwater run-off

Energy Present and Future

The home is 100% electric with zero non-renewables coming into the property, all power generated from hydroelectricity. The envelope is airtight with a 0.33 ACH_{50} and a significant thermal mass with the concrete podium and solid CLT superstructure. The R-values include 38 for walls, 48 for roofs, and 28 for the slab. The home has an Energy Use Intensity (EUI) of 8.7. A 12kW Solar PV System was installed with a Tesla Powerwall for back-up power, and electric vehicle charging. 100% LED Lighting with smart lighting (programming and remote shutoff). A wine cellar installed into the bedrock outside the envelope providing natural cooling. Also includes a Passive House certified Cat Door.

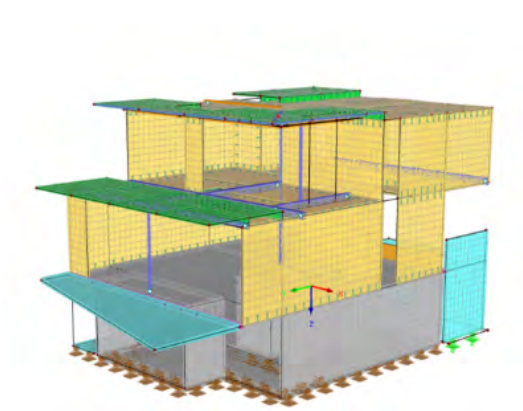
Materials and Resources

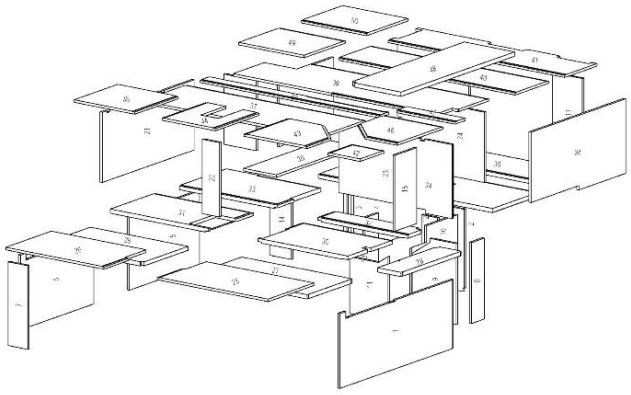
A documented waste recycling program on site diverted 84% of waste from the landfill. The owner and builder partnered with Habitat for Humanity to donate materials from demolition and construction.

The project was constructed with a clear focus on using natural materials that did not harm the environment from manufacturer through to end of life. The structure of home was constructed to last 100+ years far beyond the average life expectancy of standard single-family dwellings. Materials were selected for their durability and low-maintenance characteristics which would ensure long-term aesthetic value regardless of diligence in up-keep. The functional and unobtrusive architectural design aims to stand neutral of design trends and accommodate many future occupants.

By embracing innovative construction methods, advance products, sustainable architecture, and an understanding of building science the team demonstrated that custom homes can be built to net zero energy levels without losing desirable architectural qualities.

Building Life Cycle Considerations





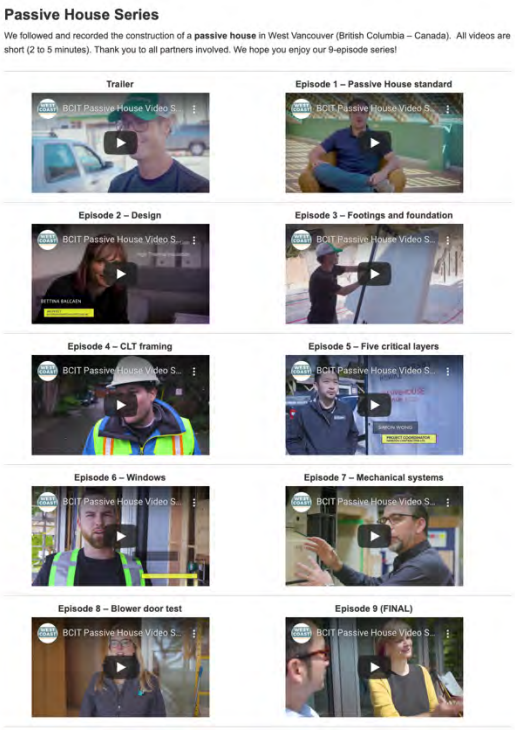
The primary structure was constructed of Cross Laminated Timber (CLT) - a Carbon storing material which also provided reduced erection time and zero waste on site. The use of prefabricated mass timber product allowed for higher fabrication quality. CLT also reduced the depth of the superstructure allowing mechanical, electrical, and plumbing equipment to be run on the underside for ease of installation, access, and future service. Highly recycled mineral wool insulation was used throughout. The project was documented following rough-in and the owner provided with a 3D Model of the actual project for any future service requirements.

Education and Information Sharing

Partnering with a local technical institute, BCIT, the team created a 9-episode video series throughout construction as an educational resource in future trades training. Students and industry leaders were invited to various mid-construction open houses to see the build in process.

The home has been featured on local news (CBC, CTV) and multiple print publications bringing sustainable buildings to the front page and educating the public on Net Zero Energy Homes and Passive House.

The WestBay Passive house has been nominated for and won several prestigious sustainable building awards which helps to promote this type of building to those looking to build their next home.



Certificate

Certified Passive House Plus

Earth Cycle Technologies
10 Springfield
Wicklow Town
Co. Wicklow
A67 F863

Authorised by:

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany

Dean & Allan Residence
3381 Radcliffe Ave, V7V 1G7 West Vancouver, Canada

Certified Passive House
Passive House Institute
| classic | plus | premium |

Client	James Dean & Janet Allan 3381 Radcliffe Ave V7V 1G7 West Vancouver, Canada
Architect	[redacted]
Building Services	
Energy Consultant	da

Passive House buildings offer excellent thermal comfort and very good air quality all year round. Due to their high energy efficiency, energy costs as well as greenhouse gas emissions are extremely low.

The design of the above-mentioned building meets the criteria defined by the Passive House Institute for the 'Passive House Plus' standard:

Building quality		This building		Criteria	Alternative criteria
Heating					
Heating demand	[kWh/(m²a)]	10	≤	15	-
Heating load	[W/m²]	10	≤	-	10
Cooling					
Frequency of overheating (> 25 °C)	[%]	3	≤	10	
Airtightness					
Pressurization test result (n_{50})	[1/h]	0.4	≤	0.6	
Non-renewable primary energy (PE)					
PE demand	[kWh/(m²a)]	102	≤	0	
Renewable primary energy (PER)					
PER-demand	[kWh/(m²a)]	43	≤	60	56
Generation (reference to ground area)	[kWh/(m²a)]	77	≥	#REF!	#REF!

The associated certification booklet contains more characteristic values for this building.

Certifier: Robert Ryan, Robert Ryan, Earth Cycle Technologies

Passive House Verification

Building:	Dean & Allan Residence		
Street:	3381 Radcliffe Ave		
Postcode/City:	V7V 1G7	West Vancouver	
Province/Country:	BC	CA-Canada	
Building type:	Single Family Residence		
Climate data set:	CA0003b-Vancouver		
Climate zone:	4: Warm-temperate	Altitude of location:	18 m
Home owner / Client:	James Dean & Janet Allan		
Street:	3381 Radcliffe Ave		
Postcode/City:	V7V 1G7	West Vancouver	
Province/Country:	BC	CA-Canada	
Architecture:			
Street:			
Postcode/City:			
Province/Country:			
Mechanical system:	Integral Group		
Street:	200 Granville St, #180		
Postcode/City:	V6C 1S4	Vancouver	
Province/Country:	BC	CA-Canada	
Energy consultancy:			
Street:			
Postcode/City:			
Province/Country:			
Certification:	Robert Ryan, Earth Cycle Technologies		
Street:	10 Springfield		
Postcode/City:	A67 F863	Wicklow Town	
Province/Country:	Wicklow	IE-Ireland	

Year of construction:	2018	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.3	IHG cooling case [W/m²]:	4.9
No. of occupants:	3.2	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	295.2				
Space heating	Heating demand	kWh/(m²a)	10	≤	15	-	yes
	Heating load	W/m²	10	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-	-	-
	Cooling load	W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C)	%	3	≤	10		yes
	Frequency excessively high humidity (> 12 g/kg)	%	0	≤	20		yes
Airtightness	Pressurization test result n_{50}	1/h	0.4	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	102	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	43	≤	45	43	yes
	Generation of renewable energy	kWh/(m²a)	77	≥	60	56	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Plus? yes

Signature:

Task:	First name:	Surname:
2-Certifier	Robert	Ryan

Certificate ID	Issued on:	City:
25084_ECT_PH_20191203_RR	08/01/20	Wicklow IE

3381 Radcliffe Ave,
West Vancouver, BRITISH COLUMBIA, V7V 1G7

ENERGUIDE

Data collected: February 11, 2019
File number: **5111N97078**
Evaluated by: Einar Halbig

0 ★This house produces more energy than it uses on an annual basis
GJ/year

0 GJ/year
Best energy performance

102 GJ/year
A typical new house

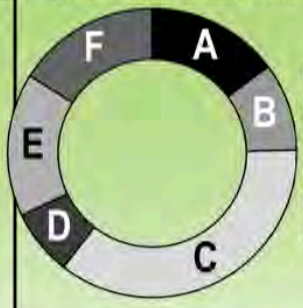
Uses most energy

One gigajoule (GJ) equals the energy from two BBQ propane tanks

Rated Annual Energy Consumption		41 GJ
• Electricity	41	
On-site renewable energy contributions		**- 41 GJ**
• Electricity	42	
• Solar water heating	0	
EnerGuide Rating:		**= 0 GJ**

Figures may not add up due to rounding.

Breakdown of Rated Annual Energy Consumption:



A	Space heating	12%
B	Space cooling	8%
C	Water heating	29%
D	Ventilation	3%
E	Lights & appliances	13%
F	Other electrical	35%

Rated Energy Intensity: **0.13 GJ/m²/year**

Rated Greenhouse Gas Emissions: **0.0 tonnes/year**

*This house has significant energy uses not included in the rating. See "House Details" on your Homeowner Information Sheet for details.

The energy consumption indicated on your utility bills may be higher or lower than your EnerGuide rating. This is because standard assumptions have been made regarding how many people live in your house and how the home is operated. Your rating is based on the condition of your house on the day it was evaluated.

Quality assured by: CHBA BC

Builder: Naikoon Contracting

Visit NRCan.gc.ca/myenerguide

Natural Resources Canada | Ressources naturelles Canada | Canada

Better Science. Better Performance. Better Bottom Line.

BUILDING KNOWLEDGE CANADA INC.

Performance Optimization Exercise

3381 Radcliffe Avenue - HERS

Subject	88% SRE, 0% LRE (21 Watts/24Hrs/64CFM)	65% SRE, 0% LRE (21 Watts/24Hrs/64CFM)	88% SRE, 66% LRE (21 Watts/24Hrs/64CFM)	78% SRE, 63% LRE (21 Watts/24Hrs/64CFM)	73% SRE, 53% LRE (21 Watts/24Hrs/64CFM)	73% SRE, 53% LRE (80 Watts/24Hrs/64CFM)
Design Loads Heating (Kbtu/Hr)	17.2	17.9	17.2	17.5	17.7	17.7
Design Loads Cooling (Kbtu/Hr)	16.2	16.3	16.2	16.2	16.2	16.3
HERS RATING	2	3	2	3	3	6
Total Annual Consumption (MMBtu/yr)	0.5	1.1	0.5	0.8	0.9	2.6
Heating	11.1	11.7	11.1	11.4	11.5	11.4
Cooling	1.2	1.2	1.2	1.2	1.2	1.2
Water Heating	8.1	8.1	8.1	8.1	8.1	8.1
Lights and Appliance	24.6	24.6	24.6	24.6	24.6	26.4
Photovoltaics Generation	- 44.5	- 44.5	- 44.5	- 44.5	- 44.5	- 44.5

3381 Radcliffe Avenue

Add scores to your site

West Vancouver, British Columbia, V7V 1G7

Commute to **Downtown West Vancouver**

38 min | 29 min | 51 min | 60+ min | View Routes

Favorite | **Map** | **Nearby Apartments**

More about 3381 Radcliffe Avenue

Walk Score 1

Car-Dependent

Almost all errands require a car.

Transit Score 41

Some Transit

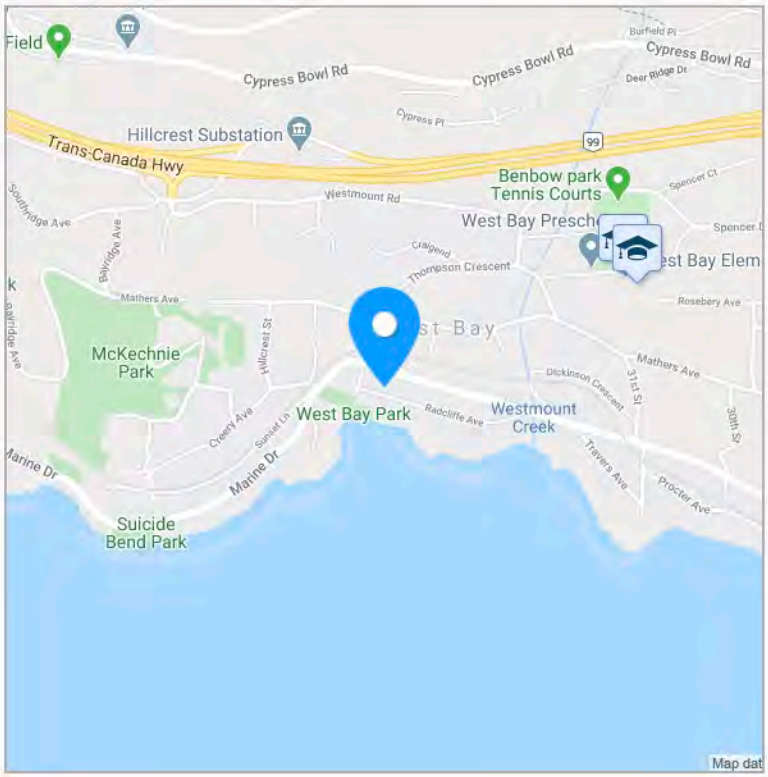
A few nearby public transportation options.

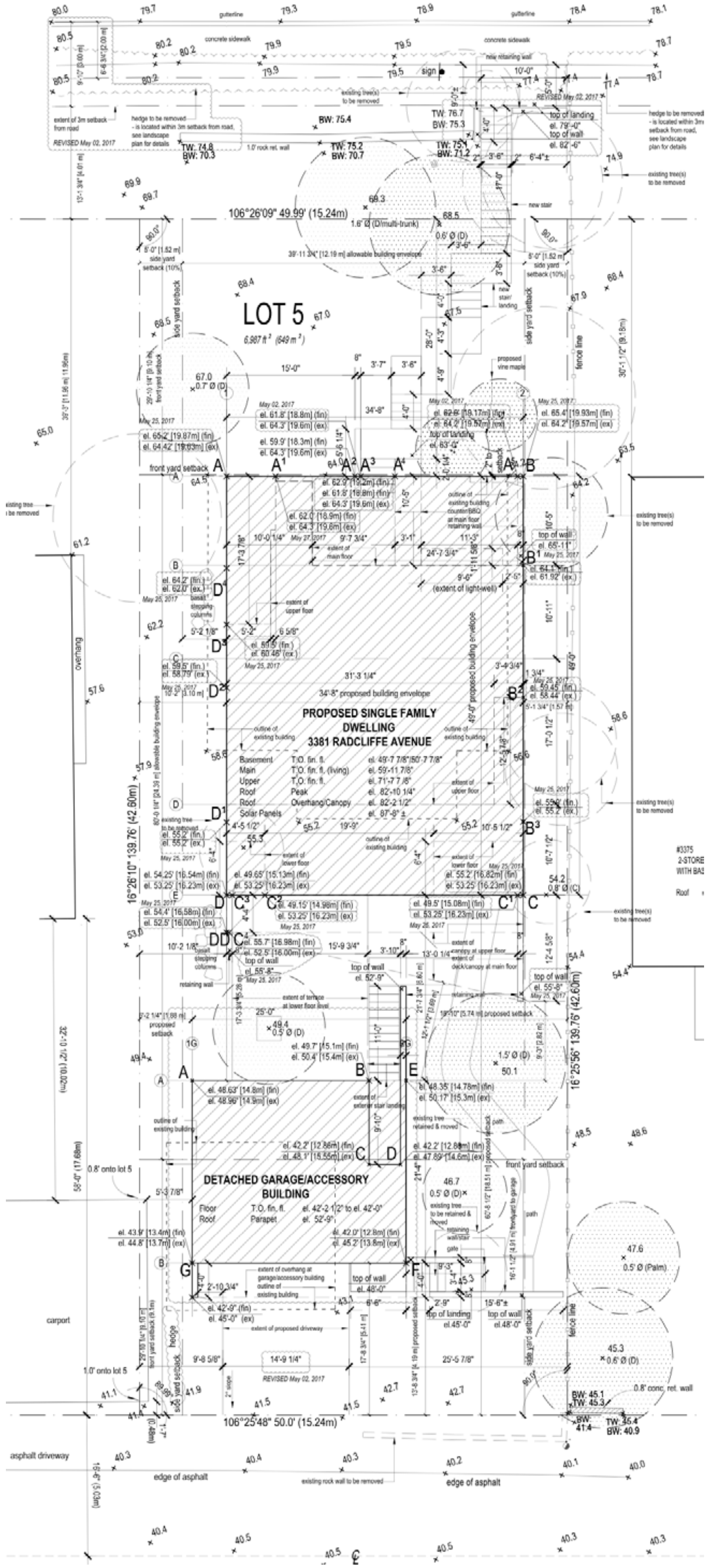
Bike Score 19

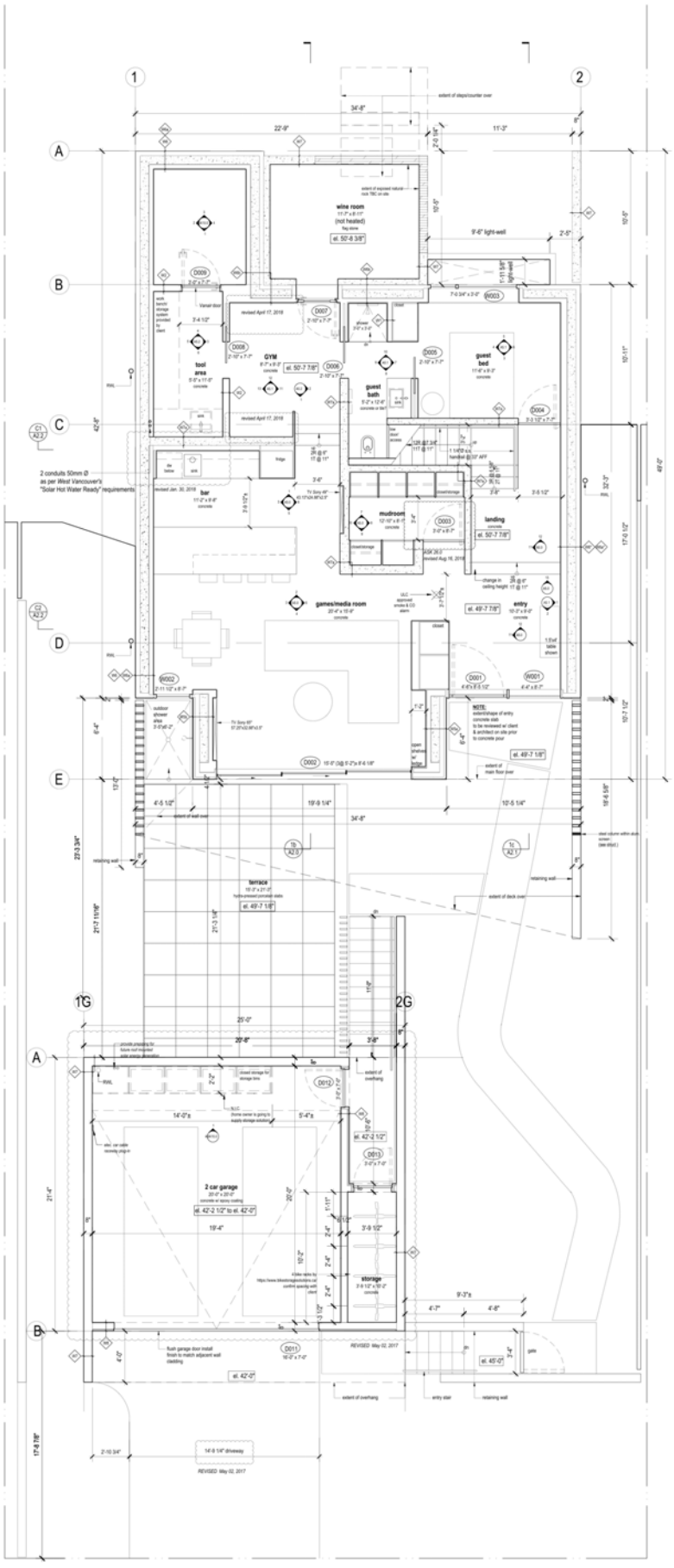
Somewhat Bikeable

Minimal bike infrastructure.

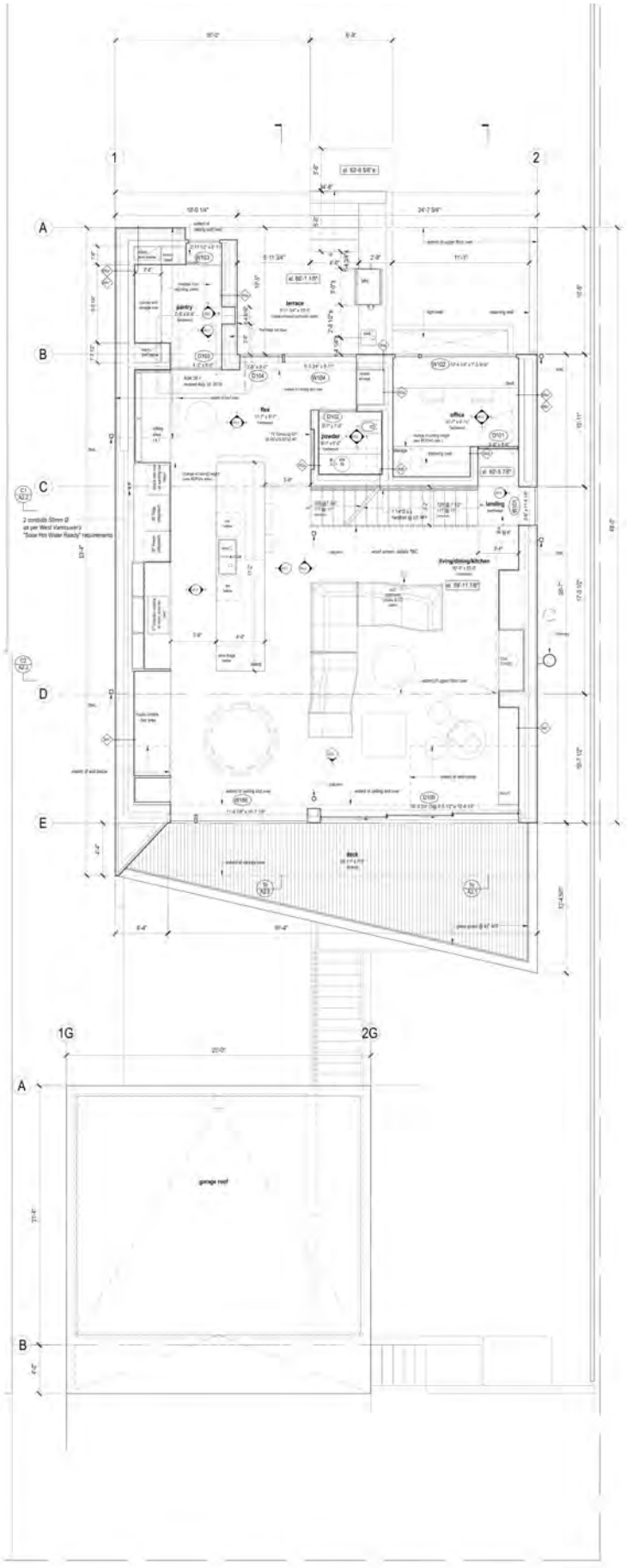
About your score



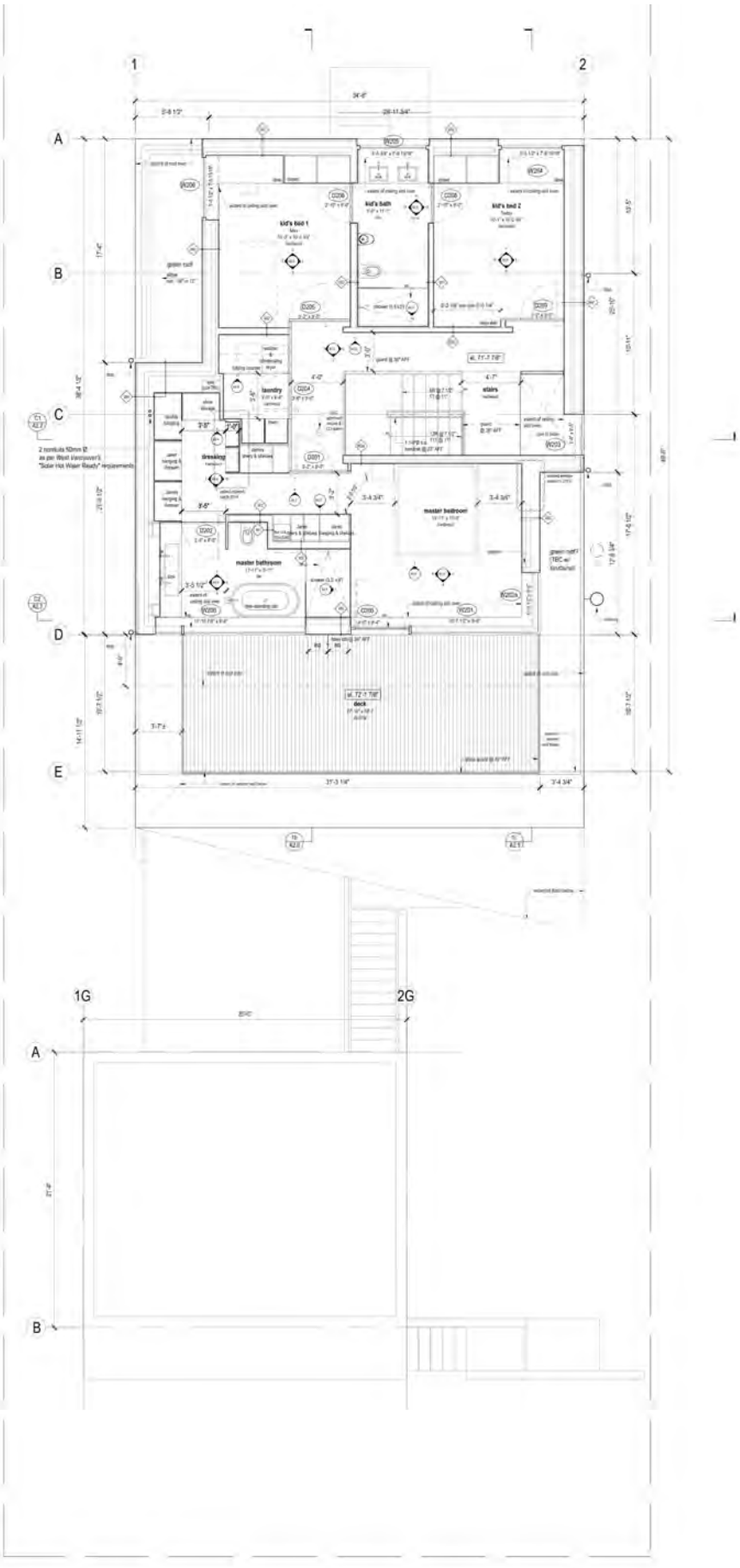

LOT 5
6,987 ft² (649 m²)
PROPOSED SINGLE FAMILY
DWELLING
3381 RADCLIFFE AVENUE
Basement T.O. fin. fl. el. 49'-7 7/8"/50'-7 7/8"
Main T.O. fin. fl. (living) el. 59'-11 7/8"
Upper T.O. fin. fl. el. 71'-7 7/8"
Roof Peak el. 82'-10 1/4"
Roof Overhang/Canopy el. 82'-2 1/2"
Solar Panels el. 87'-8" ±
DETACHED GARAGE/ACCESSORY
BUILDING
Floor T.O. fin. fl. el. 42'-2 1/2" to el. 42'-0"
Roof Parapet el. 52'-9"
106°26'09" 49.99' (15.24m)
106°25'48" 50.0' (15.24m)
16°26'10" 139.76' (42.60m)
16°25'56" 139.76' (42.60m)
34'-8" proposed building envelope
31'-3 1/4"
front yard setback
side yard setback
fence line
concrete sidewalk
gutterline
asphalt driveway
edge of asphalt
existing rock wall to be removed
carport
overhang
existing tree(s) to be removed
#3375 2-STORE WITH BAS



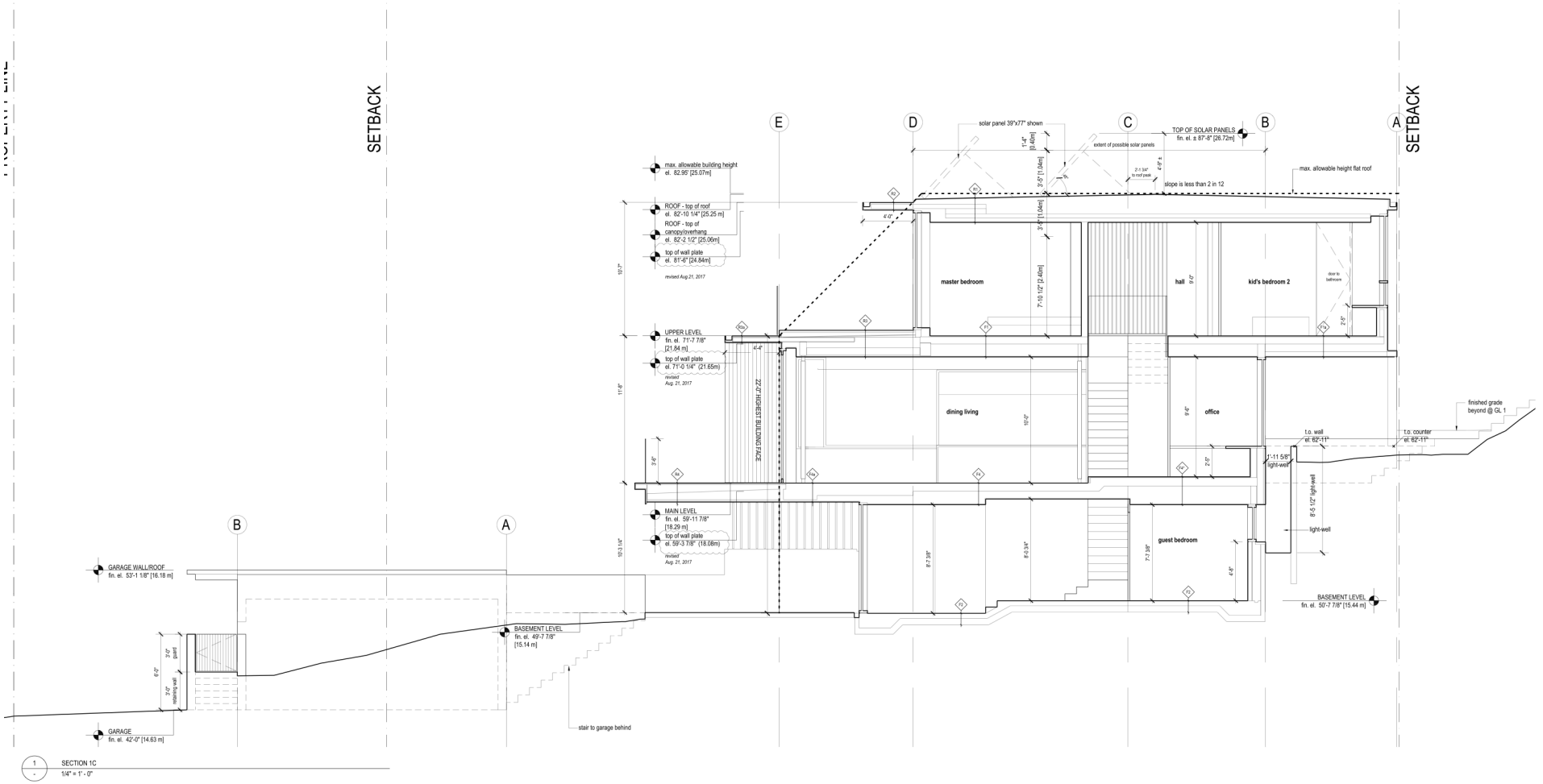
1 BASEMENT FLOOR PLAN
1/4" = 1' - 0"



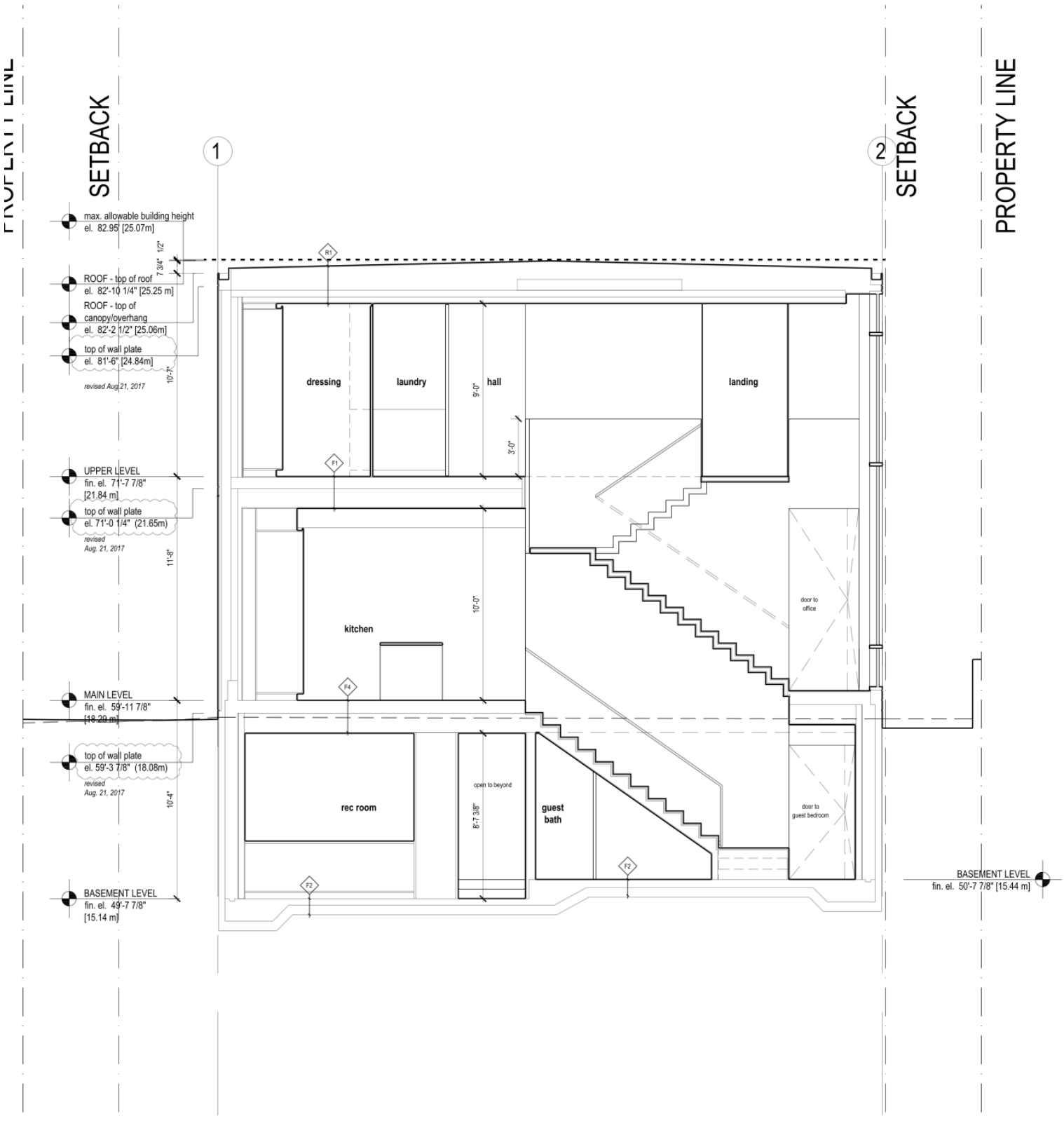
1 MAIN FLOOR PLAN
1/4" = 1'-0"



1 UPPER FLOOR PLAN
1/4" = 1'-0"

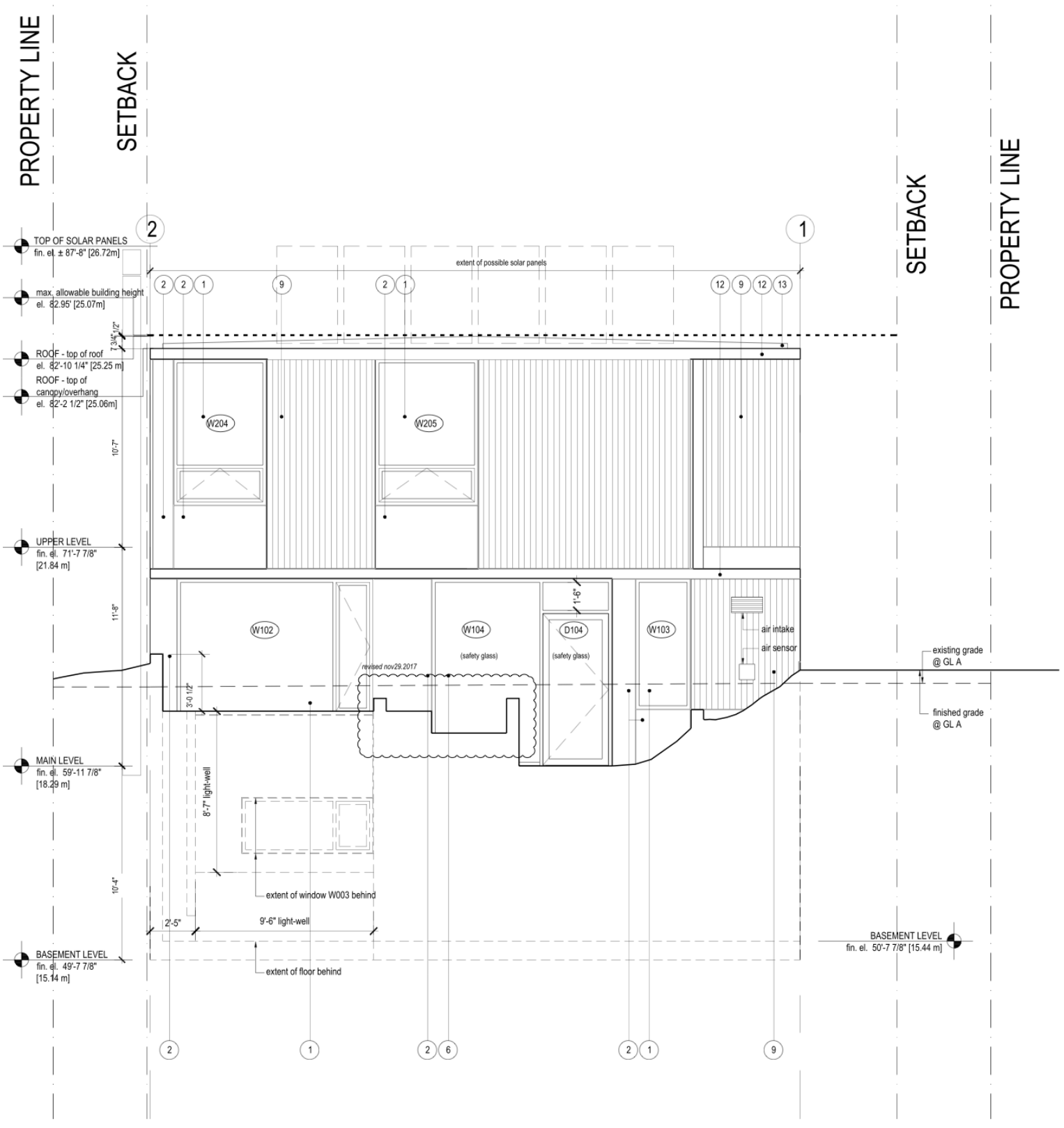


1 / - SECTION 1C
1/4" = 1' - 0"



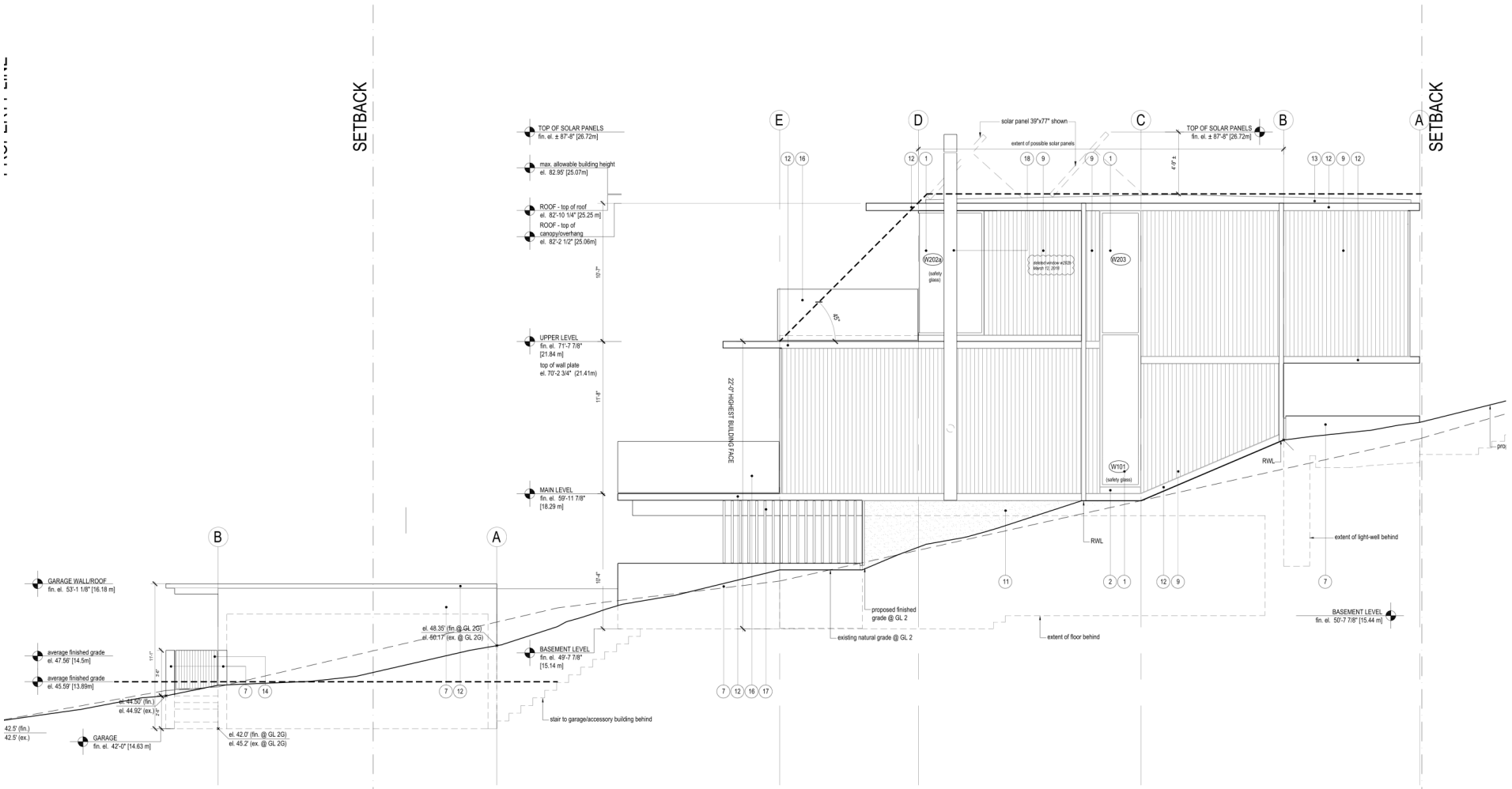
1 / - SECTION C1

1/4" = 1' - 0"

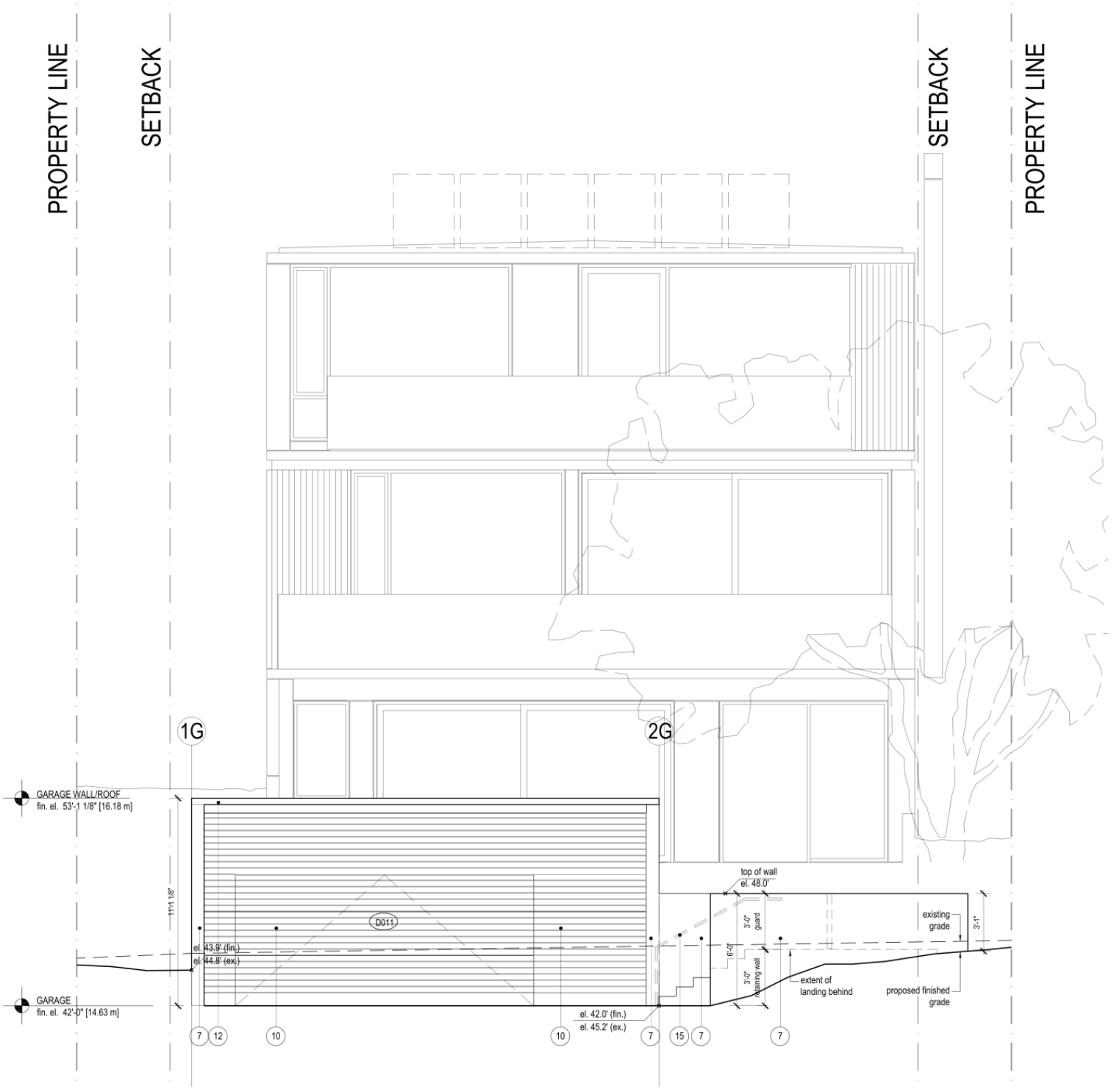


2 / - NORTH ELEVATION

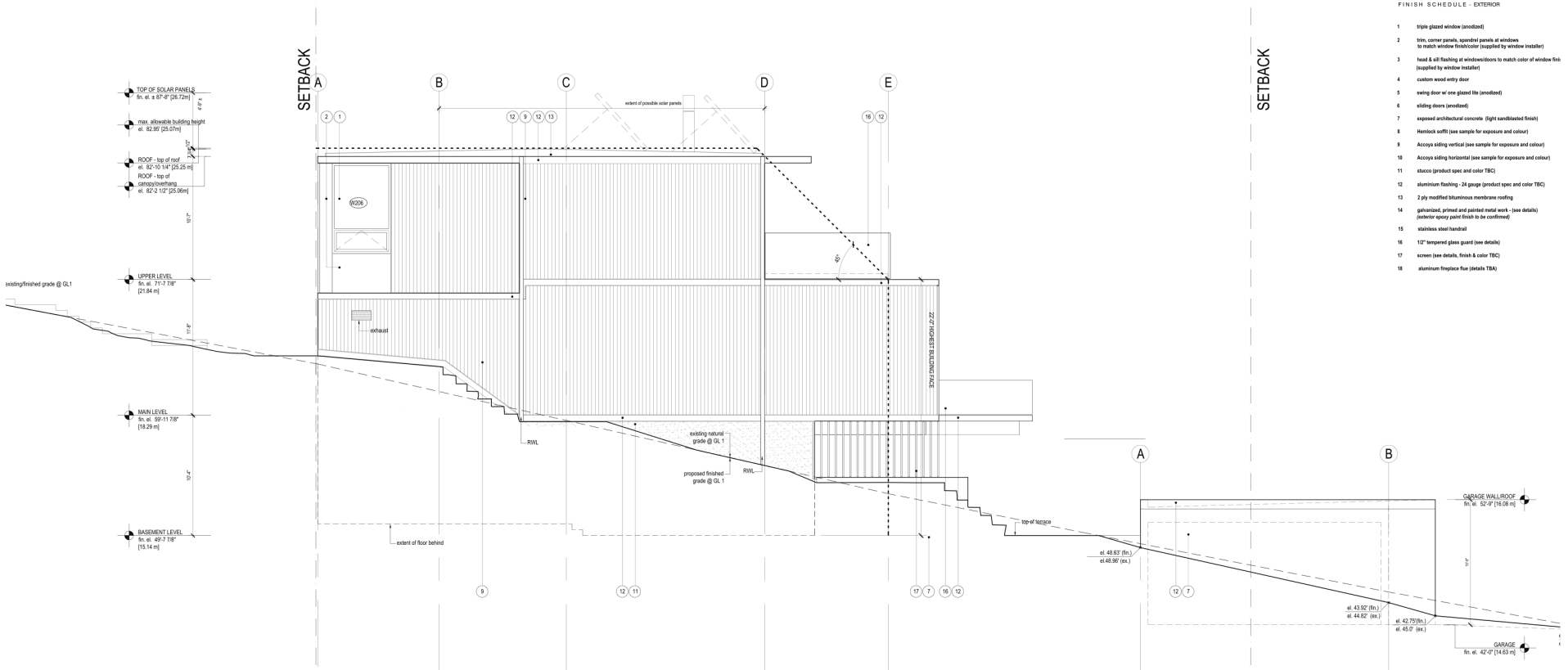
1/4" = 1' - 0"



1 / - EAST ELEVATION
1/4" = 1' - 0"



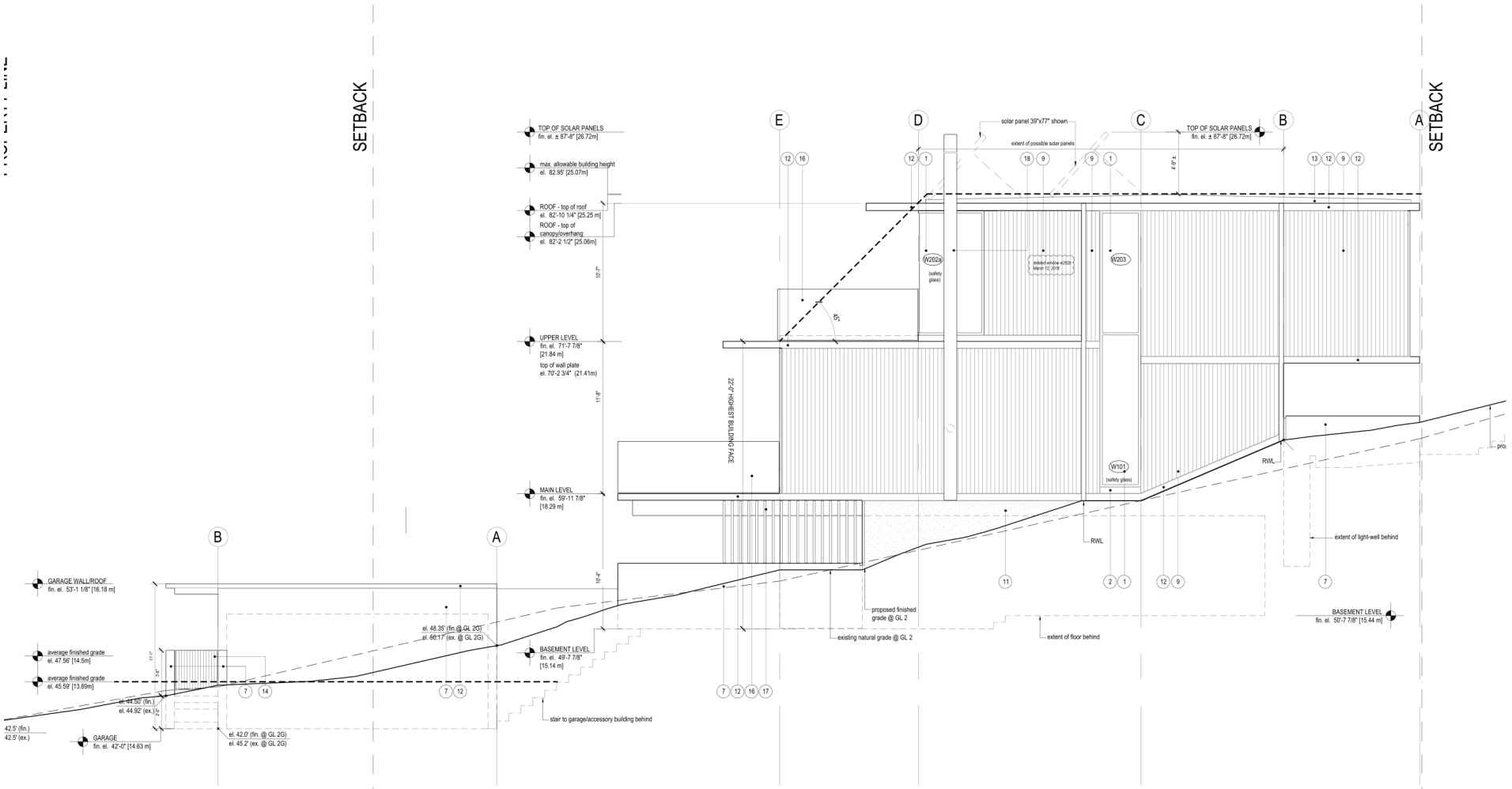
1
-
SOUTH ELEVATION GARAGE/ACCESSORY BUILDING
1/4" = 1' - 0"



1 / - WEST ELEVATION
1/4" = 1' - 0"

FINISH SCHEDULE - EXTERIOR

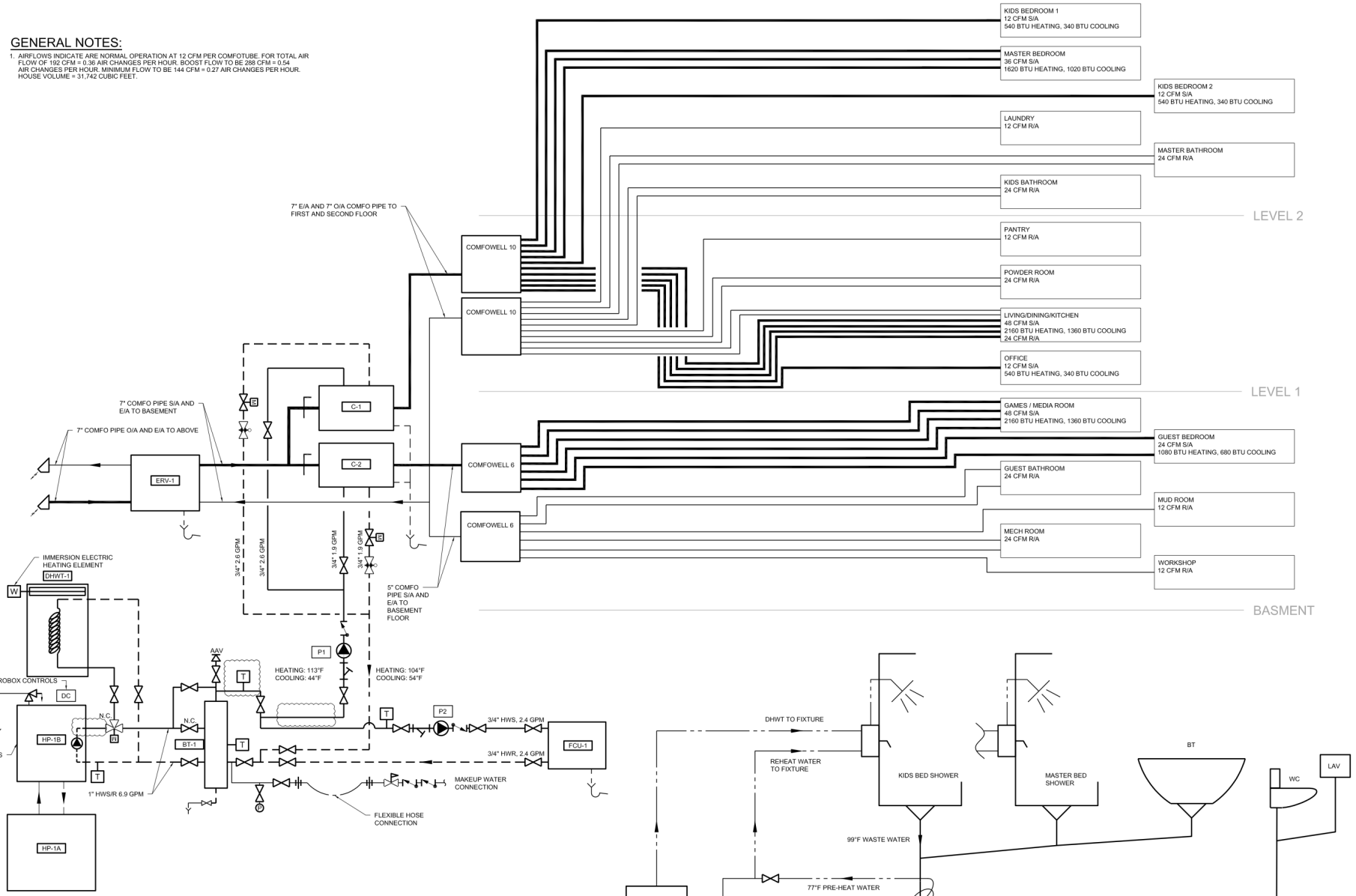
1	triple glazed window (anodized)
2	trim, corner panels, spandrel panels at windows to match window finish/color (supplied by window installer)
3	head & sill flashing at windows/doors to match color of window finish (supplied by window installer)
4	custom wood entry door
5	swing door w/ one glazed lite (anodized)
6	sliding doors (anodized)
7	exposed architectural concrete (light sandblasted finish)
8	Hemlock soffit (see sample for exposure and colour)
9	Accoya siding vertical (see sample for exposure and colour)
10	Accoya siding horizontal (see sample for exposure and colour)
11	stucco (product spec and color TBC)
12	aluminium flashing - 24 gauge (product spec and color TBC)
13	2 ply modified bituminous membrane roofing
14	galvanized, primed and painted metal work - (see details) *(exterior epoxy paint finish to be confirmed)*
15	stainless steel handrail
16	1/2" tempered glass guard (see details)
17	screen (see details, finish & color TBC)
18	aluminum fireplace flue (details TBA)



1 / - EAST ELEVATION
1/4" = 1' - 0"

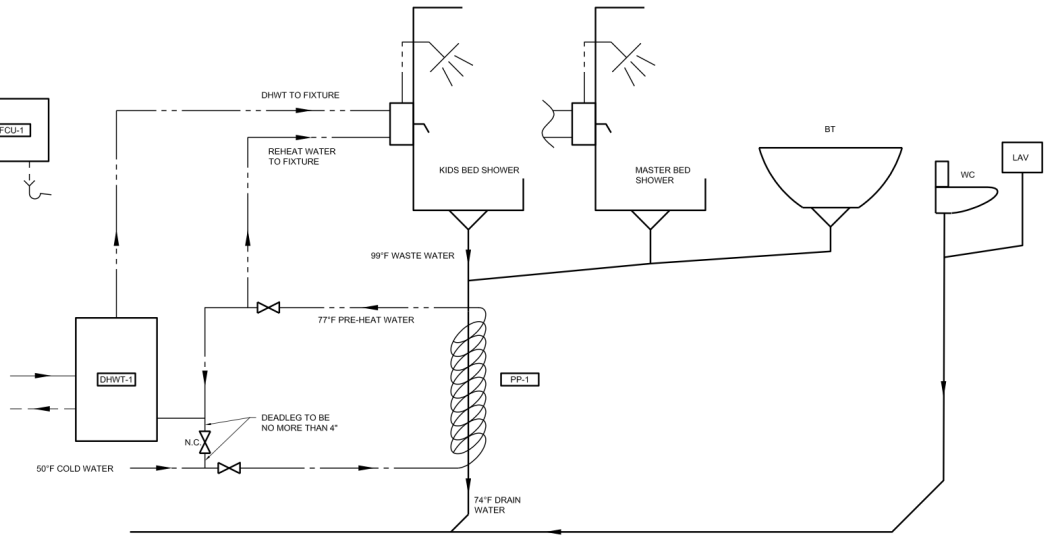
GENERAL NOTES:

1. AIRFLOWS INDICATE ARE NORMAL OPERATION AT 12 CFM PER COMFOTUBE. FOR TOTAL AIR FLOW OF 192 CFM = 0.36 AIR CHANGES PER HOUR. BOOST FLOW TO BE 288 CFM = 0.54 AIR CHANGES PER HOUR. MINIMUM FLOW TO BE 144 CFM = 0.27 AIR CHANGES PER HOUR. HOUSE VOLUME = 31,742 CUBIC FEET.



HYDRONICS AND VENTILATION SCHEMATIC

SCALE: N.T.S.



DOMESTIC HOT WATER REHEAT DETAIL

SCALE: N.T.S.


3381


Miele
Miele