

① 3D Site

Habitat for Humanity

By Om Patel

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Project Lead the Way
Habitat for Humanity

No.	Description	Date

Title Page & Table of Contents

Project number	Project Number	A100
Date	3/1/24	
Drawn by	Author	
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Project Description

The goal of this project is to design an affordable home that follows the guidelines of Habitat of Humanity. Specifically, this home should accommodate those with all disabilities and their children following the state laws. To make this home affordable it must be single story with no garage and a 4" crawl space. My client needs a home to accommodate his single arm and 2 young girls. This means that the home should be no bigger than 900 sq ft. and have at least one bathroom. Furthermore, to make the home as accommodatable as possible it should include a 5' diameter area of rotation for people in a wheelchair. To make the home not only cost-effective on purchase but also in the future, it must be energy efficient. Some actions taken to do so are orienting the home so it would not have to use as much heat in the winter, placing trees down to block shade in the summer, and using 2x6 studs and high r-value insulation in the walls. I also followed the regulations for electrical plans and wastewater to make my home as regulatory and effective as possible. Finally, in the construction of the home, I followed any specific requests made by the client such as adding a patio.



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Habitat for Humanity

No.	Description	Date

Project Description

Project number	Project Number
Date	3/11/24
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	Scale

A99

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Client Survey

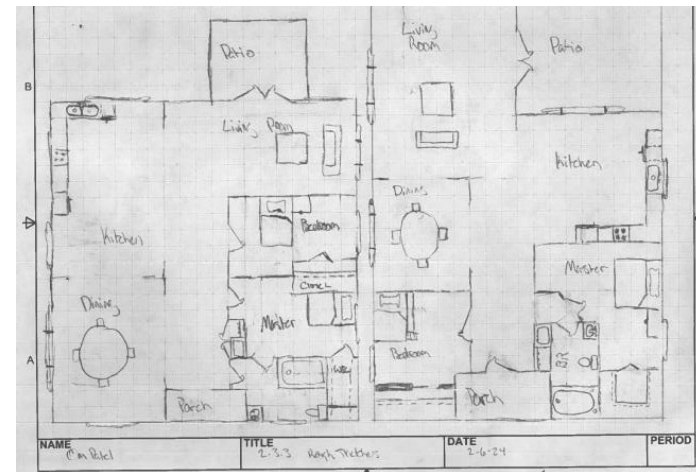
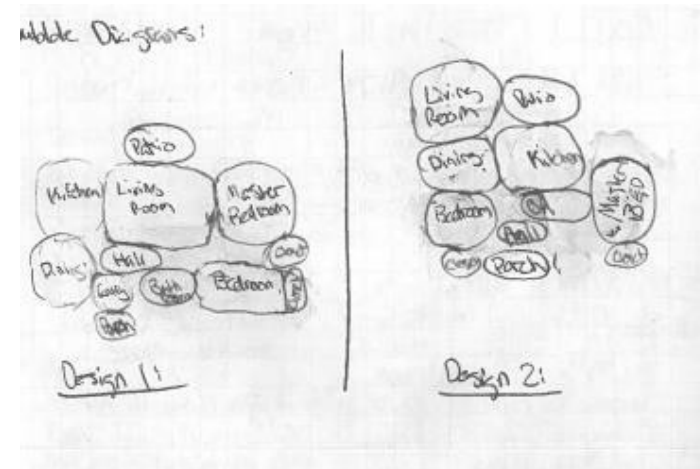
Family Information	
Adult Names/Ages	Eric Deppe – 54 Will Dunham - 55
Occupations	Stay at home dad / Veteran (Eric) Painter (Will)
Child Names/Ages	Gianna – 7
Child Names/Ages	Alexa – 8.5
Physical Disabilities	One Arm – Eric
Other Special Needs	None
Pets	None
Architectural Details	
House Style	Modern
Number of Bedrooms	2
Number of Bathrooms	1
Square Footage	~900
Deck or Patio	Patio
Extra Storage	No
Leisure Activities	
Hobbies	Pickelball Tournaments
Entertainment	Painting art
Equipment	Painting brushed / Paint
Special Needs	
Disabilities/illness	Alexa/Gianna – Depressed
Energy Saving/ LEED Concepts and Ideas	
Site Development	2x6 Studs to decrease heat loss
Water Savings	Modern
Energy Efficiency	Extra glazed windows
Materials Selection	
Indoor Environmental Quality	
Other Ideas	
	Pool
	Walk In Closet
	Big Living Room/Family Room

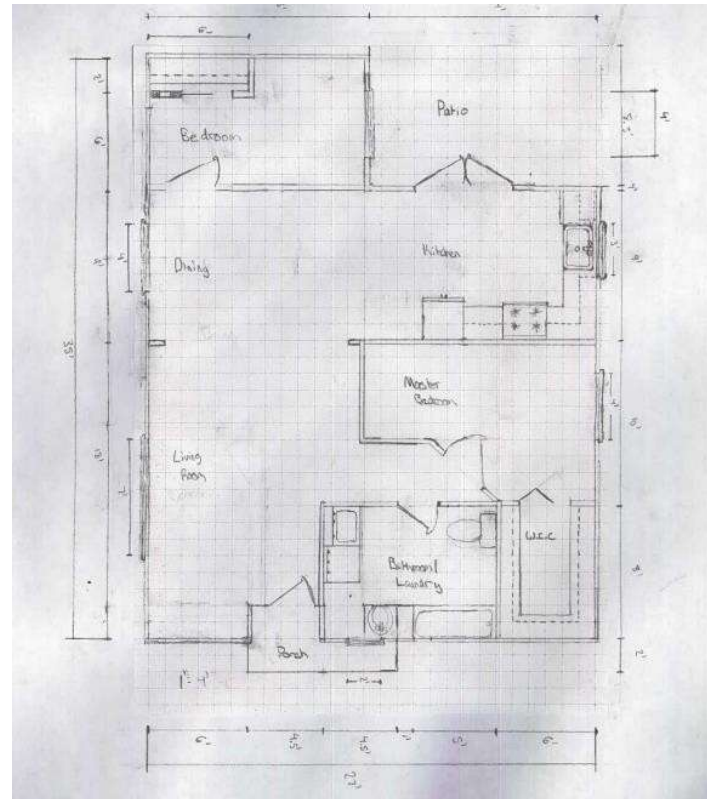
Client Survey

To understand my client's needs, I first began by taking a client survey. This allowed me to understand what he would need to accommodate their children and themselves. Furthermore, it would help me add in any personalization's my client would want such as a patio.

Sketches

After learning my clients preferences, I could then create a bubble diagram for 2 different design concepts. Using those bubble diagrams I could quickly make a rough draft of the two concepts and ask my client which idea they like more. With the idea selected I could then make a scale final sketch that indicated any important feature and accommodated with the Habitat of Humanity guidelines and state laws





Water Supply Calculations

To make sure a home has adequate water pressure, one must calculate the losses made by a pipes length to check whether a home may need a pressure regulator or water pump.

In this home, based on factors such as the length of pipes and height of the water tower, it has sufficient water pressure for residential use.

1. a) Static Head: $872.81 \text{ ft} - 763.5 \text{ ft} = 109.31 \text{ ft}$

Static Pressure: $\frac{109.31}{2.31 \text{ ft}} \cdot \frac{\text{psi}}{2.31 \text{ ft}} = 47.32 \text{ psi}$

b) Minor Length:

	Quantity	length	Total
90 degree elbow	7	12	84
45 degree elbow	1	7.7	7.7
Total			91.7 ft

Major Length: $3.12 \text{ mi} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} = 16473.6$

Total Length: $16473.6 + 91.7 = 16565.3$

Head Loss

$h_f = \frac{10.44 \cdot 16565.3 \cdot 100 \text{ lbs}}{100 \text{ lbs} \cdot 8 \cdot 4.8655} = 6.98 \text{ ft}$

c) Dynamic Head: $109.31 - 6.98 \text{ ft} = 102.33 \text{ ft}$

d) Actual Pressure: $102.33 \cdot \frac{\text{psi}}{2.31 \text{ ft}} = 44.3 \text{ psi}$

e) Yes this is sufficient for residential use.

DESIGNED BY: Ch Patel DATE: 2.27.24

WITNESSED BY: _____ DATE: _____

PROPRIETARY INFORMATION
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Storm Water Runoff Calculations

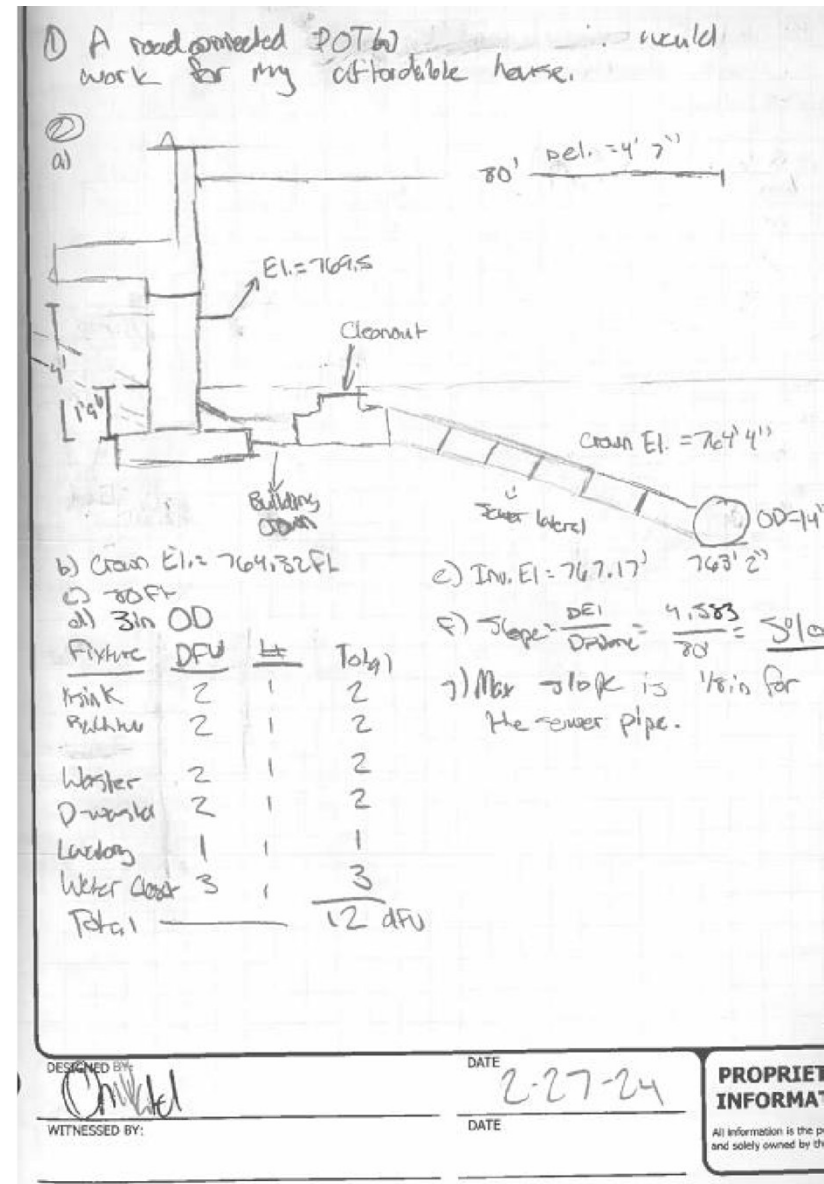
When a property is developed, it is important to understand that changes to watershed characteristics will change the amount of storm water runoff from the site. Adding more development will increase the amount of runoff, so in construction it is best to use materials that are permeable and to reduce runoff. Making these calculations allowed me to see what type of water collection system I could use to help reduce storm water runoff.

Specifically, I used rain buckets that can hold up to 1600 gallons of water.

NAME	① $Q = C_f C_i A$	Forest $C_f = 1.1$
On Page	50'x35' Coffee Shop = .04 acres	$C = .95$
	100'x120' Parking Lot = .28 acres	$C = .95$
	1.184 Sandy Soil, Well-Drained	$C = .175$
	Forest:	
	C_f C i A	
	1.1 \cdot 0.1295 2.45 1.5 = .52 cF	
	After:	
	$\frac{(.95)(.04) + (.95)(.28) + (.175)(1.184)}{1.5} = .34$	
	$Q = (1.1)(.34)(2.42)(1.5) = 1.36 \text{ cF}$	
	$\Delta Q = 1.36 - .52 = .84 \text{ cF}$	
	② 900 sq ft roof	
	$i = .118 \text{ in/hr}$	
	Total rain fall = $(24)(.118) = 2.83 \text{ in}$	
	Volume = $(900)(2.83)(\frac{1}{12}) = 213 \text{ Ft}^3 = 1594 \text{ gal}$	
	Multiple rain buckets w/ a total of 1600 gals would help w/ water storage	
DATE	5-12-23	
PERIOD		

Wastewater Calculations

When designing an affordable home, one must consider how the waste will be dispensed. It is common that these home use publicly owned treatment works to get rid of their waste but to do so an engineer must design how the waste will reach the public sewer main. Using information from the location of the site I created the building's sewer.



Heat Loss Calculations

Heat loss helps one determine the heating and power requirements a home might have. For this project we were challenged to find the heat loss of our home using the materials in a wall/roof system.

4 2.2.3 Heat Loss 7.6 in

① Normal Outside Temp: 9
 Walls x 3.21 = 8.16
 Blower x .2431 = .414

Door = 7.2 in x 7.8
 Windows = 2.6 x 4.6
 Location = Benton, MA
 Inside Temp = 70°F

Material	R Value
Walls	3.21
Door	7.2
Windows	2.6
Blower	.2431
Insulation	1.05
Inside Air Film	1.68

Total = 14.13

② Wall Wall R-value: 14.13

U = 1/R = 0.07

③ DT = Outside - Inside
 DT = 9 - 70
 DT = 61°

④ DT = 91 - 70
 DT = 21°

⑤ AUST

Roof = (2.6 x 4.6 x 1.05) = 12.4
 Windows = (1.6 x 1.6 x 1.05) = 2.6

DESIGNED BY: Oni Patel DATE: 2-5-24

WITNESSED BY: _____ DATE: _____

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5 2.2.3 Heat Loss 7.6 in

① 5007 ≈ 5000 Btu/hr heater in Winter
 16.8 x 45012000 = 4174 ≈ 6000 ≈ 5.6 in PK in the Summer.

② A heater with a pump of 5000 Btu/hr is similar to that of a size heater.

③ Wall

Material	R Value
Walls	3.21
Door	7.2
Windows	2.6
Blower	.2431
Insulation	1.05
Inside Air Film	1.68

Total = 14.13

④ DT = Outside - Inside
 DT = 9 - 70
 DT = 61°

⑤ DT = 91 - 70
 DT = 21°

⑥ AUST

Roof = (2.6 x 4.6 x 1.05) = 12.4
 Windows = (1.6 x 1.6 x 1.05) = 2.6

DESIGNED BY: Oni Patel DATE: 2-5-24

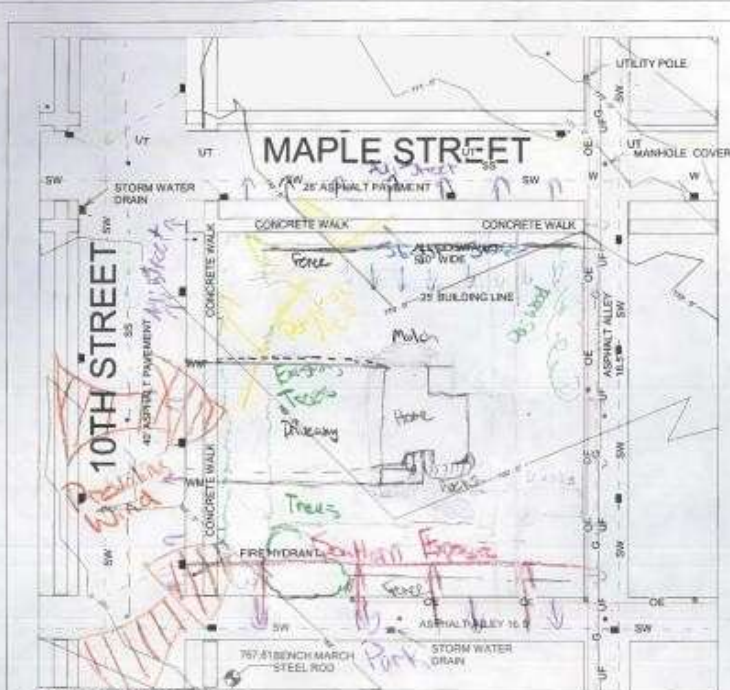
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Site Plan Opportunities

To create a home as efficient as possible one must consider factors such as solar orientations, wind orientation, and sound orientation. All of these can affect a home's efficiency in different seasons as they can increase or decrease the amount of heat or A/C one might need.

For this home I orientated it south to get the most amount of sun light and placed trees in the west and south to protect it from the wind, sound, and sun that come from that direction.



1 HABITAT FOR HUMANITY SITE
1" = 30'-0"

ZONING

FRONT SETBACK 35'
SIDE SETBACK 25'
REAR SETBACK 10'
ADJACENT 20'
MAX HEIGHT (4 STORES)

BENCH MARKS

BM 1
STEEL ROD
ELEV. 757.81

LEGEND

- - - - - SW - - - - - STORM WATER SEWER LINE
- - - - - G - - - - - UNDERGROUND GAS LINE
- - - - - W - - - - - UNDERGROUND WATER LINE
- - - - - UT - - - - - UNDERGROUND TELEPHONE LINES
- - - - - UF - - - - - UNDERGROUND FIBER OPTIC LINES
- - - - - SS - - - - - SANITARY SEWER LINES
- - - - - OE - - - - - OVERHEAD ELECTRIC LINES
- FIRE HYDRANT
- UTILITY POLE
- MANHOLE COVER
- STORM DRAIN
- WM WATER METER

MAP



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No.	Description	Date

Site Plan

Project number: Project Number
Date: Issue Date
Drawn by: Author
Checked by: Checker

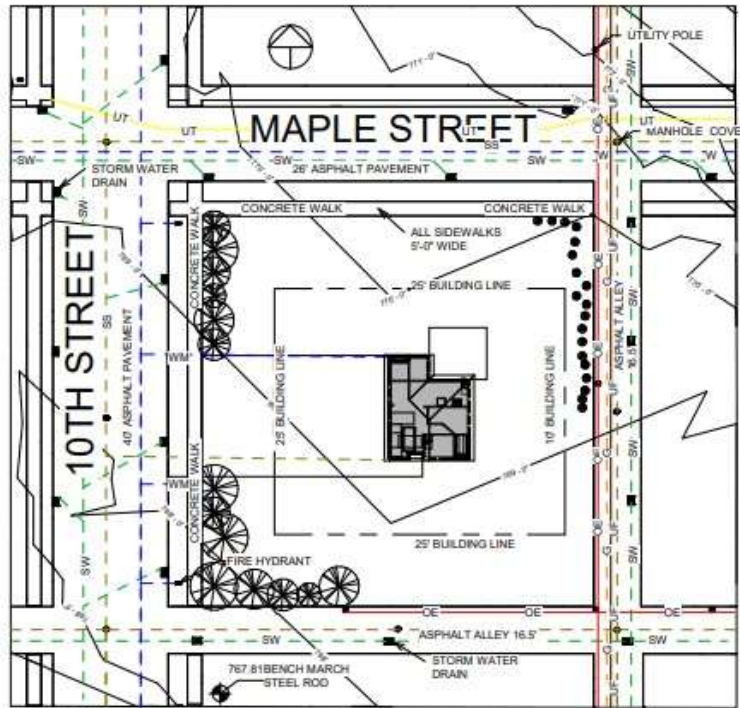
A101

Scale: 1" = 30'-0"

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Revit

For the rest of the project, I inputted all my information into Revit. Revit is a CAD using in the civil engineering industry to model a home and its site. I created things such as the site plan, floor plan, a bathroom and kitchen, wood framing/structure, and schedules.



① HABITAT FOR HUMANITY SITE
1" = 30'-0"

ZONING

FRONT SETBACK 25'
SIDE SETBACK 25'
REAR SETBACK 10'
ADJACENT 20'
MAX HEIGHT (4 STORIES)

BENCH MARKS

BM 1
STEEL ROD
ELEV. 767.81

LEGEND

- SW- STORM WATER SEWER LINE
- G- UNDERGROUND GAS LINE
- W- UNDERGROUND WATER LINE
- UT UNDERGROUND TELEPHONE LINES
- UF UNDERGROUND FIBER OPTIC LINES
- SS- SANITARY SEWER LINES
- OE OVERHEAD ELECTRIC LINES
- FIRE HYDRANT
- UTILITY POLE
- MANHOLE COVER
- STORM DRAIN
- WM WATER METER

LOT 8, SQ. 23
PROPERTY
AREA
5 ACRES

MAP



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Project Lead the Way
Habitat for Humanity

No.	Description	Date

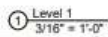
Site Plan

Project number Project Number
Date 3/1/24
Drawn by Orit Patel
Checked by Eric Deppe

A101

Scale 1" = 30'-0"

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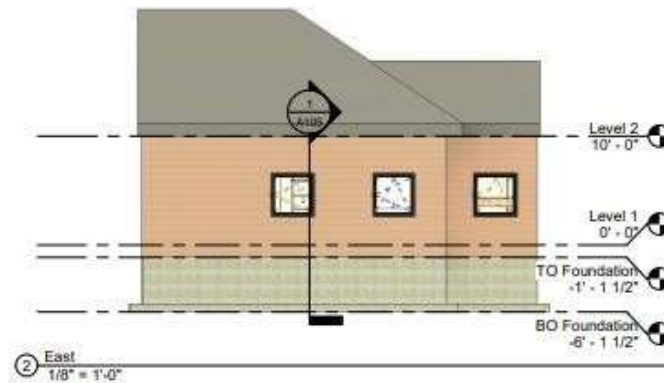
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Floor Plan

Project number	Project Number	A102
Date	3/11/24	
Drawn by	Author	
Checked by	Checker	
		Scale 3/16" = 1'-0"

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Habitat for Humanity

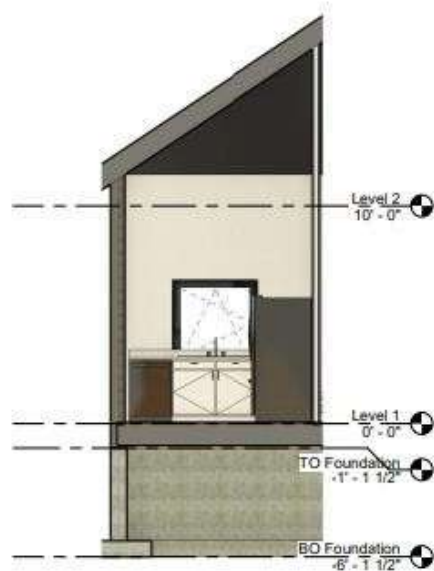
No.	Description	Date

Elevations

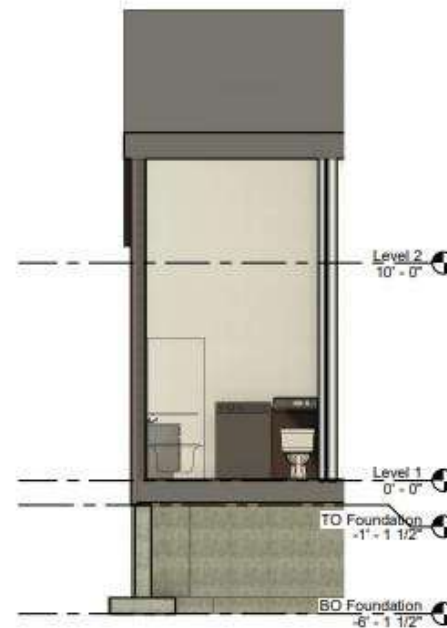
Project number	Project Number
Date	3/11/24
Drawn by	Author
Checked by	Checker
Scale: 1/8" = 1'-0"	

A103

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① Kitchen
1/4" = 1'-0"



② Bathroom
1/4" = 1'-0"



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No.	Description	Date

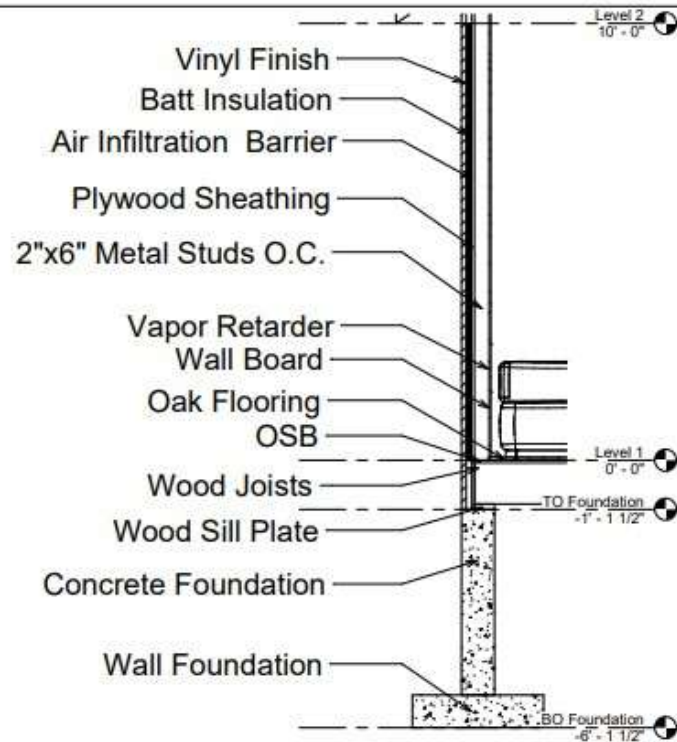
Kitchen & Bathroom

Project number: Project Number
Date: 3/11/24
Drawn by: Author
Checked by: Checker

A104

Scale: 1/4" = 1'-0"

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① Cross Section
1/2" = 1'-0"



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No.	Description	Date

Cross Section

Project number	Project Number	A105
Date	3/11/24	
Drawn by	Author	
Checked by	Checker	
		Scale: 1/2" = 1'-0"

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Door Schedule			
Description	Count	Height	Width
One Panel Door	5	6' - 11 3/16"	3' - 0 27/32"
Sliding Door	1	6' - 10"	4' - 0"
French Door	1	6' - 11 1/16"	7' - 3 13/32"

Window Schedule			
Description	Count	Height	Width
Double Sash Window	5	4' - 0"	4' - 0"
Double Sash Window	1	4' - 10 9/32"	8' - 0 27/32"



① Window and Door



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No.	Description	Date

Schedules		
Project number	Project Number	A106
Date	3/11/24	
Drawn by	Author	
Checked by	Checker	
		Scale

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Electrical Plan

Using AutoCAD and my floorplan created in Revit I was able to create an electrical plan following regulation. This included using specified outlets in certain area such as GFIs in wet areas. Planning the electrical system of a home is important as the location of outlets and wires may affect the way a home may aesthetically look.

LEGEND

	ELECTRICAL PANEL
	SINGLEPLEX RECEPTACLE
	DUPLEX RECEPTACLE
	GFI DUPLEX RECEPTACLE
	TRIPLEX RECEPTACLE
	RANGE RECEPTACLE
	SINGLE FLOOR OUTLET
	DUPLEX FLOOR RECEPTACLE
	TELEDATA OUTLET
	TELEVISION OUTLET
	TELEPHONE JACK
	SINGLE POLE SWITCH
	DOUBLE POLE/SINGLE THROW SWITCH
	THREE WAY SWITCH
	DIMMER SWITCH
	CEILING-MOUNTED LIGHT FIXTURE
	RECESSED LIGHT FIXTURE
	WALL-MOUNTED SCONCE
	FLUORESCENT LIGHT FIXTURE
	EXTERIOR SPOTLIGHT
	CEILING FAN

