



Affordable X Design Housing Playbook

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omaha
by design



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Introduction

Omaha, like cities across the nation, is in the midst of an affordable housing crisis. At Omaha by Design, we recognize that housing can either be a barrier or a gateway to accessing civic life and equitable opportunities for prosperity.

Recognizing Omaha by Design's unique position, we launched the first phase of the Affordable by Design Housing Playbook in 2021 to help:

- Address the “affordability gap” in home design, construction, financing, operation, and maintenance
- Broaden access to wealth-building through home-ownership
- Provide for a wide variety of family structures and cultural preferences
- Introduce and employ universal design best practices
- Identify and implement construction efficiencies to reduce up-front and life-cycle costs
- Promote people- and neighborhood-centered urban design.

Conceived as an open-source set of housing prototypes, the goal was to develop a resource that will help potential homeowners and small developers understand what is possible on the typically narrow lots in Omaha's older neighborhoods.

Along with our professional and community partners, we have worked to create a conceptual design that accommodates the conditions of urban infill sites, complements and enhances existing neighborhoods, and

allows potential homeowners to have agency over the final design while using a simple base prototype.

The design shown within this document is conceptual and is intended to provide homeowners, developers, and builders with an idea of what they can do on their own properties. The base design is simple - a rectangular footprint for the house, and another rectangular footprint for the attached garage - but is paired with a number of customization options including material palettes and roof forms to ensure that the resulting homes are anything but cookie cutter.

The simplicity of the base plan is intended to provide a straightforward building envelope that can be constructed out of a variety of typical construction systems--from stick framed to structurally insulated panels. This is intended to allow flexibility to accommodate owner/developer preferences as well as changes in material and labor markets.

But design alone can't mitigate all of the volatility in today's construction and home-buying climate and solve for affordability. As such, this study is intended to be just one tool in a set, providing conceptual plans that can be partnered with financing, development incentives, and other components within the development ecosystem to create an affordable product.

Scott Dobbe

Executive Director, Omaha by Design



Project Background

Highlander + 30th Street

Seventy Five North Revitalization Corporation, a key partner in this study, is a non-profit that has facilitated the revitalization of Highlander, a mixed-use community in North Omaha that has been developed along 30th Street between Parker and Lake, and 28th and 31st Streets. Based upon the purpose-built community model, the neighborhood works to “facilitate the revitalization of a healthy, sustainable, mixed-income community and break the cycle of poverty and community deterioration by creating high-quality housing, thriving schools, recreational facilities, and other neighborhood enrichment opportunities.”

Built on the former site of the Pleasantview Homes, a 300-unit public housing site, Highlander has been a catalyst for development and activity. Master planning for the neighborhood started in 2014 and included mixed-income townhomes, apartments, and senior living units, along with a mixed-use commercial and community building. A single-family, owner-occupied component was planned for the eastern most portion of the site, between 28th and 29th Streets.

The first phase of development was completed in 2017, and consisted of over 100 mixed-income townhomes and apartments, along with the Accelerator, a commercial building hosting various community partners, local businesses, a community event hall, a coffee shop, and food hall. This was followed by the senior living building in early 2021.

The next phase started construction in 2022 and will add additional rental units and commercial space to the 30th Street corridor.

A graphic on the following page, taken from a 2018 Linear Park Study by APMA and TENxTEN landscape architects, shows the 30th Street corridor from Highlander to Spencer Homes, with hatching indicating vacant lots. From this you can see that the previously dense residential neighborhood has been depleted through the demolition of homes, leaving a neighborhood with immense potential for single-family infill housing.

In 2019, the City of Omaha and the Omaha Housing Authority, along with 75North as a community partner, were awarded a Choice Neighborhood Implementation (CNI) Grant to redevelop Spencer Homes, a public housing community at 30th and Spencer, and revitalize the 30th Street corridor. Additional infill single-family development along the corridor will extend and complement the work of both Highlander and the CNI grant at Spencer Homes.

HIGHLANDER

Images, from upper left, clockwise: The Venue at Highlander; Highlander Courtyard apartments; Founder's Row East townhomes; Hardy Coffee at the Highlander Accelerator; The Heights apartments; Founder's Row West multi-generational townhomes. All photos are for reference only.



As a partner in this study, 75North will develop up to 28 urban lots based upon this study's design concept. Their goal is to provide market-quality homes, a product that is currently hard to find in the neighborhood. 75North will be leveraging additional funding sources to help bridge the gap between construction price and sale price, particularly in early phases which will have few neighborhood comparables that can be referenced for financing.

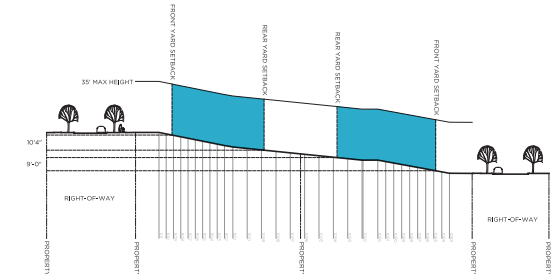
The development of these owner-occupied homes offers a rare opportunity to test our conceptual ideas in a very quick time frame

while also developing a library of construction documents to complement the conceptual drawings shown within this document. It is intended that the concepts within this study can evolve with these early homes to reflect lessons learned, and extend the value of this playbook.

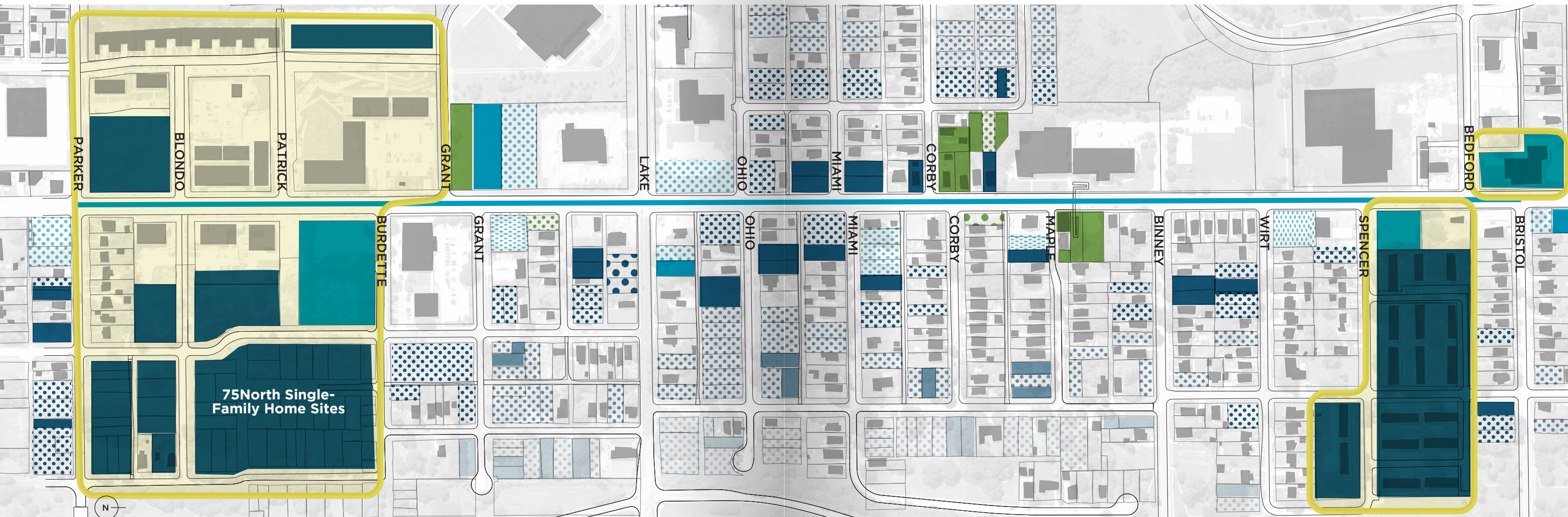
For the purpose of this document, the original 75North lots between Parker and Burdette, and 28th and 29th Streets have been used as a case study. The lots provide a challenging variety, with a minimum lot size of 40' x 113' and grade changes of up to 15'. To accommodate this, we have developed three base prototypes:

- A walk-out basement concept that works with the extensive grade change on the lots north of Blondo Street (see plan on opposite page) and can be located on a narrow 40' wide lot.
- A single-story plan with an optional basement that provides for additional accessibility and can be located on slightly wider lots of 120' or longer.
- A two-story, small footprint option with an optional basement that can be accommodated on narrow and shallow lots.

These sample plans may not cover all sites and programs, but are intended to provide a framework that can be used to develop additional plans and designs that respond to the unique conditions of infill sites.



Typical site cross-section of 75N sites between 29th + 28th Streets, north of Blondo Street.



Graphic adapted from 2019 Highlander Linear Park Master Plan & Concept Design Study, completed by Alley Poyner Macchietto Architecture and TEN x TEN Landscape Architecture and Urbanism

Stakeholder + Partner Input

During the summer of 2021, the study team, including representatives of Omaha by Design, Seventy Five North, and Alley Poyner Macchietto, met with community stakeholders to determine what potential homebuyers in the neighborhood are looking for and what is currently lacking within the existing building stock.

First, the team met with staff representatives of Family Housing Authority Services (FHAS), an Omaha non-profit whose “mission is to improve housing opportunities and eliminate poverty.” The FHAS staff provided valuable

input, while also allowing us to distribute a study to current participants in their first-time homebuyer program.

We also met with Angel Starks, a Realtor familiar with the market around Highlander as well as in Omaha as a whole. Her experience and insight were invaluable to the creation of this document.

Documentation of all stakeholder engagement meetings and surveys can be found in the appendix of this document.

Program

Through the stakeholder engagement process it became apparent that there are gaps in the housing products that are available in and around Highlander and North Omaha. For those looking to buy in the neighborhood it is less about what they and their family want, and more what they and their family will settle for.

The survey of FHAS participants, which was also distributed in a second cohort to existing rental tenants at Highlander, was key in identifying a program for the prototype.

On the opposite page we have outlined program components - number of bedrooms, type of floor plan - that were identified as ideal.

Not all of the prototypes within this document provide all of the preferred program components due to site, configuration, or size constraints, but all program elements are represented in at least one prototype to provide an example of how they can be accommodated.

Preferred Program

3-4 bedrooms
with option for additional bedrooms, mother-in-law suite, or accessory dwelling unit

2+ bathrooms
provide at least one shower and one bathtub

main-level primary bedroom
with dedicated or connecting bathroom

entry/drop-zone
provide a proximate coat closet or casework/shelving

dining
provide dining-only “zone;” doesn’t need to be enclosed

kitchen
island preferred, “L” shape
option for larger families

basement
can be planned for future finish; ideally includes a secondary gathering space/family room

outdoor space
provide a public-facing front “porch” and private outdoor spaces in side or rear yards

indoor/outdoor connections
locate outdoor spaces adjacent to indoor gathering spaces

Goals + Aspirations

In addition to the nuts and bolts of the program, we also wanted to identify aspirational elements that should be reflected in the final design. These range from neighborhood engagement to accommodating aging in place.

Universal Design

Nationwide, fewer than five percent of living units are livable for individuals with moderate mobility difficulties, while wheelchair accessible units represent less than one percent. This means that there are only 15 affordable, accessible units available for every 100 households that need them.

Providing more accessible housing stock benefits everyone, not only those that are currently seeking accessible options. Increased accessibility within homes provides for the long-term needs of residents by accommodating aging-in-place, multi-

generational living, and ease of living with the temporary mobility restrictions, such as a broken limb or recovery from surgery, that can and will affect all of us.

To help provide resources for potential homeowners and developers, Assistology, LLC has developed an overview of accessibility needs within the affordable housing sphere along and best practices for integrating accessible features. This information is found in the appendix of this document.



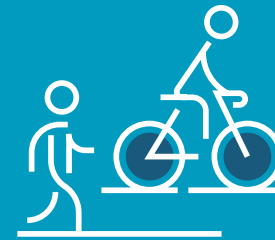
PROVIDE SPACES FOR GATHERING, IN THE HOME AND NEIGHBORHOOD



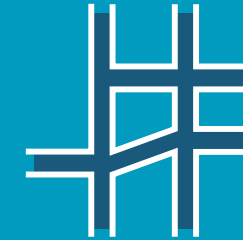
ALLOW FOR OWNER CUSTOMIZATION



GET THE MOST OUT OF EVERY SPACE



ACCOMMODATE AGING IN PLACE AND VARYING MOBILITY LEVELS



NEIGHBORHOOD CONNECTIVITY/ ENGAGEMENT



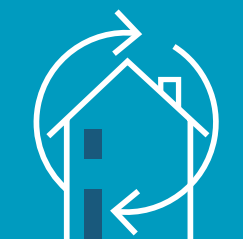
PLAN FOR THE FINANCING PROCESS + REQUIREMENTS



PLAN FOR FUTURE ADDITIONS AND RENOVATIONS



PROVIDE HIGH-QUALITY OUTDOOR SPACES



PRIORITIZE SUSTAINABILITY + LONG-TERM EXPENSES

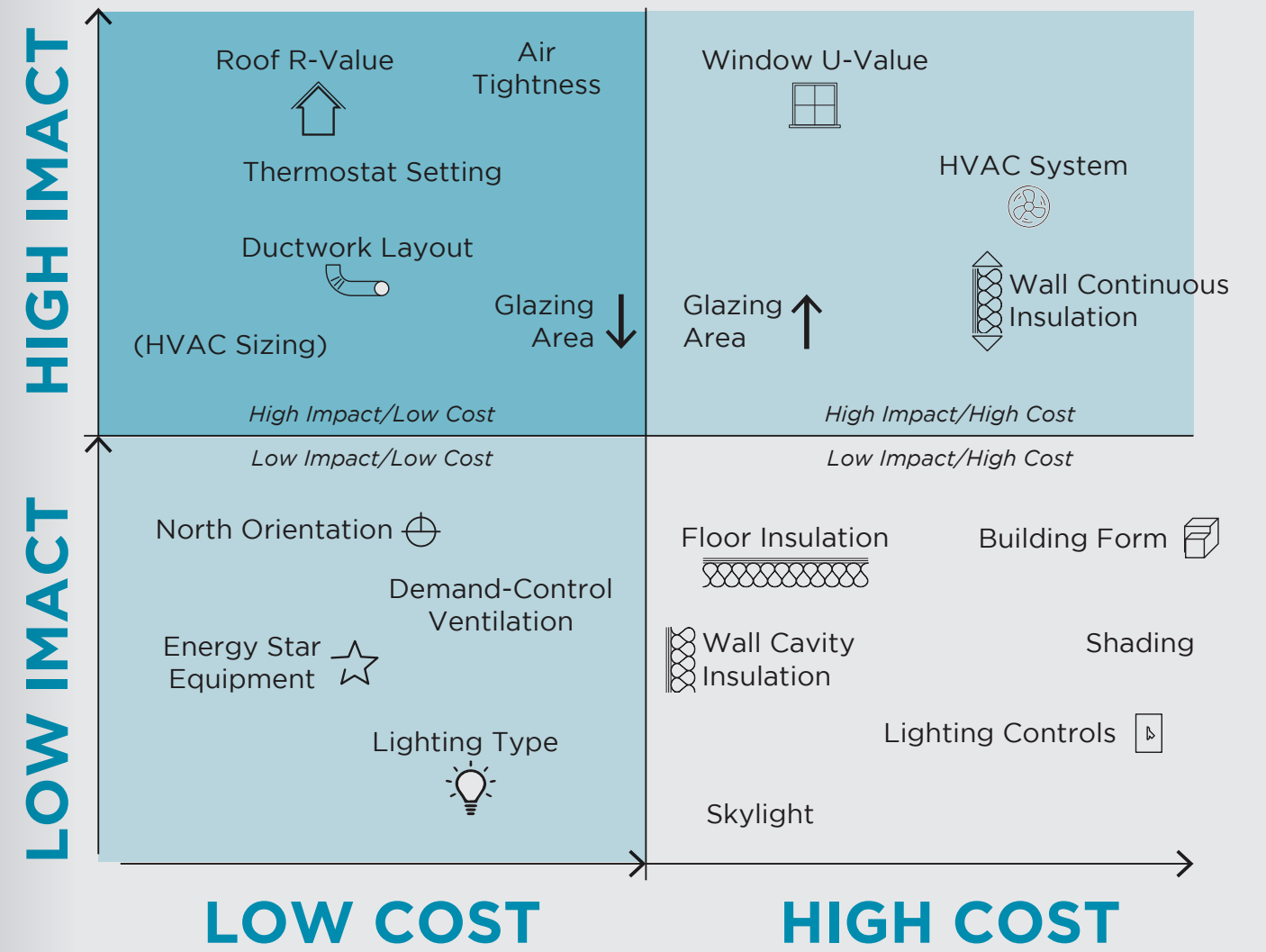
Energy Analysis + Best Practices

Long-term operations and maintenance should be considered early in the design process, both to minimize a home's environmental impact and to realize savings for the homeowner in the form of reduced utility costs. Balancing up-front costs with long-term-savings can help homeowners or developers prioritize high-impact, energy and cost saving solutions.

Morrissey Engineering, Inc. has developed a high-level guide that outlines how building design and construction decisions can impact a home relative to energy, sustainability, and air quality.

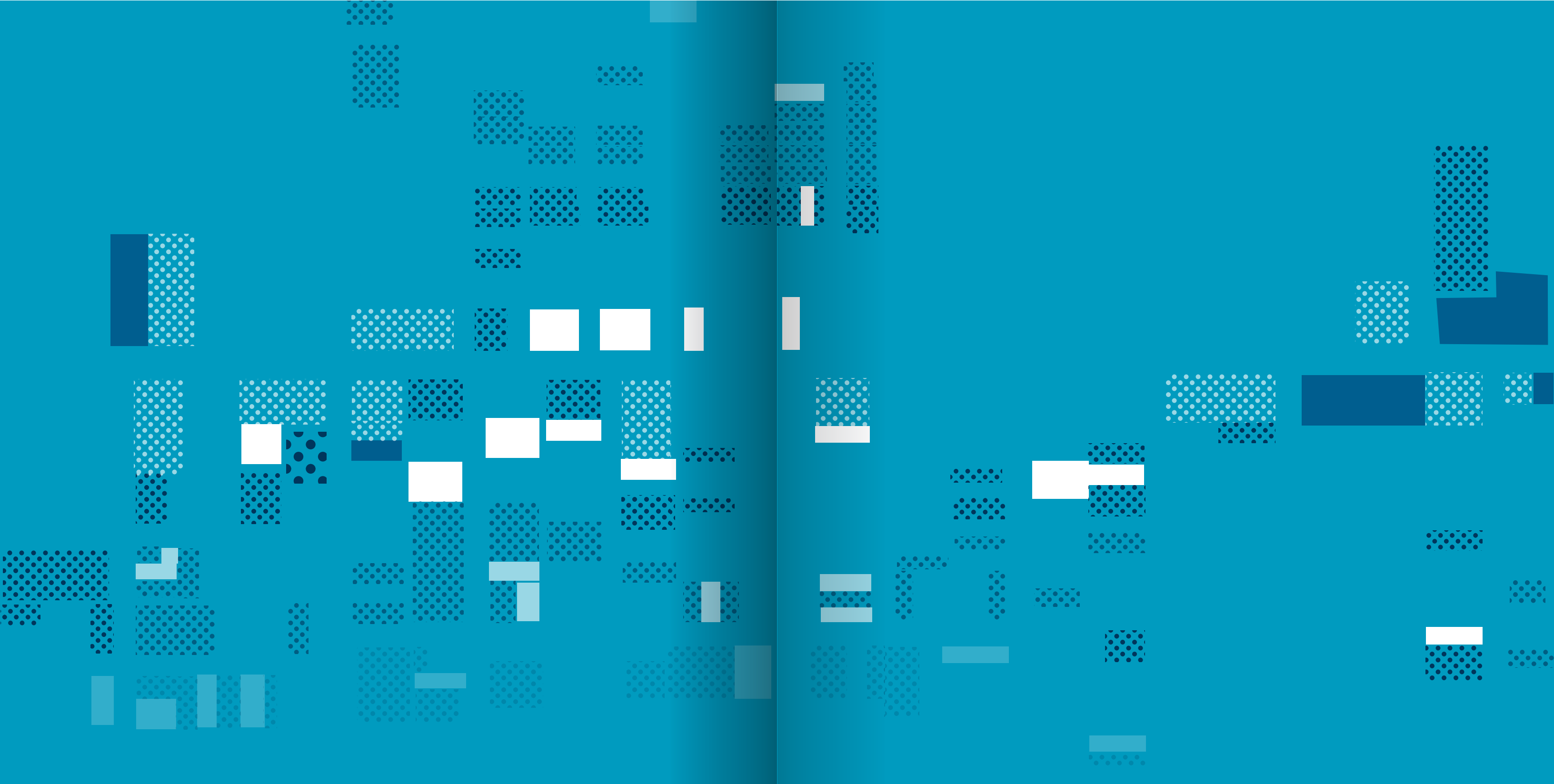
On the following page you can see the full guide can be found in the appendix of this document. It can help inform decisions from early in the process, such as choosing a site and determining building orientation, to best practices in construction. Topics include:

- Analysis of up-front costs vs. long-term savings.
- How building orientation can affect heat gain, such as minimizing west-facing glazing to reduce summer and fall heat gain, while strategically increasing south-facing glazing to maximize passive solar heat gain in the winter.
- Considerations for solar panels.
- Best practices for building envelopes, such as air seals and framing.
- How to choose a mechanical system that increase energy-efficiency and have a relatively short payback period, with long-term savings on utilities.
- Selecting healthy materials such as paints that have low-VOC (volatile organic compounds).



Energy Modelling Bundles + Energy Savings

| Input | Baseline | Bundle 01 | Bundle 02 | Bundle 03 |
|----------------|-----------------------------|--|------------------------------|------------------------------|
| WINDOW U-VALUE | 0.3 BTU/h ft ² F | 0.23 BTU/H FT ² F | 0.16 BTU/H FT ² F | 0.20 BTU/H FT ² F |
| WINDOW SHGC | 0.5 | 0.61 | 0.56 | 0.23 |
| ROOF R-VALUE | R-34.5 | R-34.5 | R-45 | R-60 |
| WALL R-VALUE | R-16.7 | R-16.7 | R-16.7 | R-20 |
| COST PREMIUM | Baseline (none) | Could be added if \$/SF values are provided for enclosure variable inputs in Table 5 | | |
| PAYBACK (YRS)* | | | | |
| ENERGY SAVINGS | | 10% | 15% | 20% |



Site/Conditions Analysis

Zoning + Typical Infill Sites

As noted previously in this document, in the Highlander + 30th Street section, the planned single-family lots to be developed by 75North were used as a case study for the prototype. However, this study is also intended to provide resources for all potential infill sites within all of the older neighborhoods of Omaha and beyond.

On the upper half of the opposite page you can see a table that outlines the site regulators (set-backs, maximum heights, etc.) for residential zoning categories from R-3 to R-8. For our purposes, it is likely that the potential sites for this prototype would be zoned R-4 and higher, so we assumed a 25' front yard setback, 25' rear yard setback, 15' side yard setback, and 5' interior side yard setback as the standard condition. We also assumed interior lots (opposed to corner lots).

On the lower half of the opposite page we've provided a diagram that shows typical lot sizes and configurations (interior versus corner lots) and the developable footprint that remains once setbacks have been accommodated.

The first step when developing an infill lot should be to identify just how developable a specific lot is. Many of the most restrictive examples in this diagram are outliers - a 30' wide single corner lot being a great example. However, many lots within older neighborhoods may be difficult to develop, and this should be considered before buying.

For additional detail - and a fun read - the full Omaha zoning code can be found at this [link](#).

Site Regulators

| | | Zoning Designation | | | | | | |
|---|--|--------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | | R-3 | R-4 | R-5 | R-WRN | R-6 | R-7 | R-8 |
| Single-Family Detached Site Regulators | Lot Area | 7,500 sf | 5,000 sf | 4,000 sf | 5,000 sf | 4,000 sf | 4,000 sf | 4,000 sf |
| | Min Lot Width | 60' | 50' | 40' | 50' | 40' | 40' | 40' |
| | Min Site Area/Unit | 7,500 sf | 5,000 sf | 3,000 sf | 2,500 sf | 2,000 sf | 4,000 sf | 4,000 sf |
| | Floor Area Ratio | No Restriction | No Restriction | No Restriction | No Restriction | No Restriction | No Restriction | No Restriction |
| | Max Height | 35' | 35' | 35' | 35' | 35' | 75' | 150' |
| | Max Building Coverage | 35% | 40% | 50% | | 55% | 60% | 70% |
| Minimum Single-Family Detached Setbacks | Max Impervious Coverage | 45% | 50% | 60% | | 65% | 70% | 80% |
| | Front Yard* | 35' min | 25' min | 25' min | 15' max** | 25' min | 25' min | 25' min |
| | Street Side Yard | 17.5' min | 15' min | 15' min | 15' max** | 15' min | 15' min**** | 15' min**** |
| | Interior Side Yard | 7' min | 5' min | 5' min | 5' min | 5' min | 5' min | 5' min |
| | Interior Side Yard W/ Opposing Zero Lot Line | 15' min | 10' min | 10' min | 5' min | 10' min | 7' min | 7' min |
| | Rear Yard | 25' min | 25' min | 25' min | 25' min*** | 25' min | 25' min | 25' min |

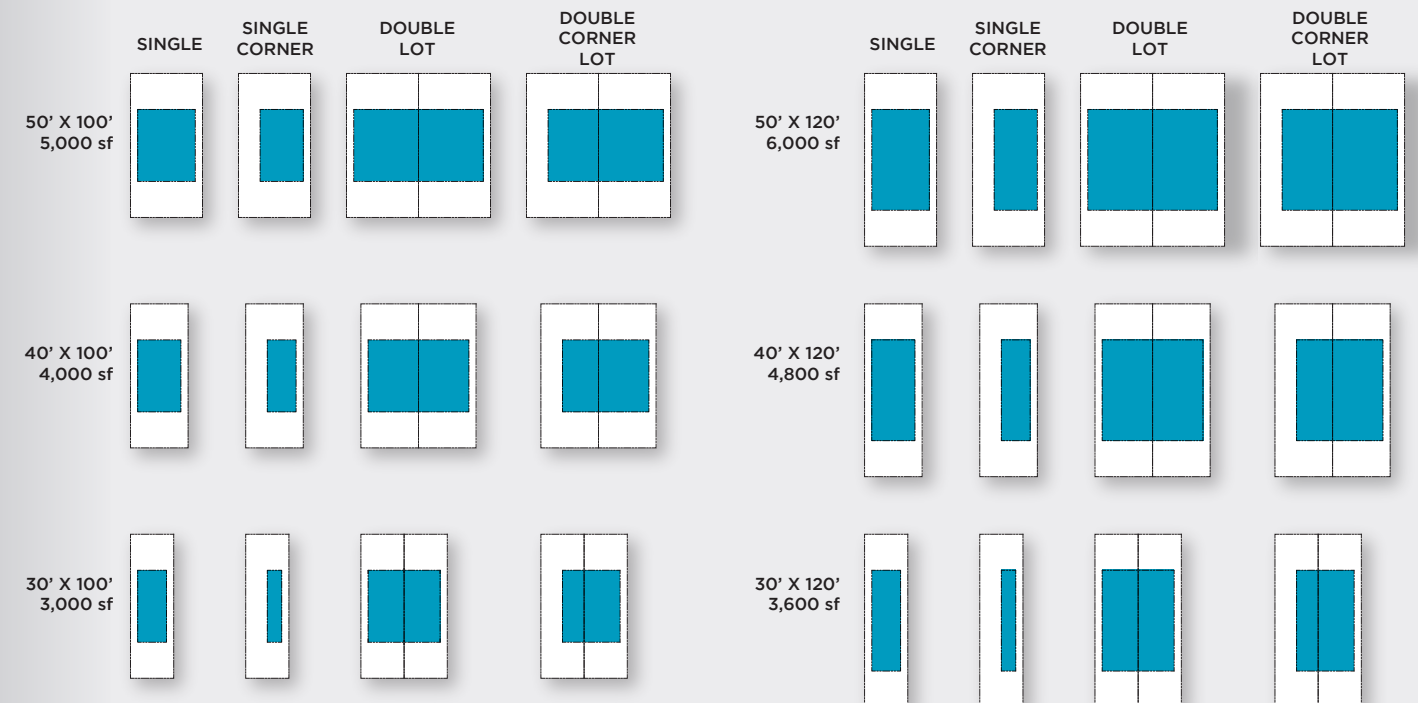
* Front yard setback adjustment. All new construction within areas zoned and developed with a 35-foot minimum front yard setback, prior to the effective date of this chapter [March 4, 1987], shall maintain that setback. These areas will be designated as R5(35) on the official zoning map of the city.

** 60 percent of each facade facing a street shall be located at a line removed from and parallel to such street at a distance to be determined at the time of adoption of an R-WRN district, but in no event greater than 15 feet.

*** Garage structures may be located within the required rear yard setback area if such structures face a one-way rear alley and are set back at least five feet from said alley.

**** 2 additional feet for each 10 feet or fraction thereof in height over 45 feet.

Typical Platted Lots



Neighborhood Context

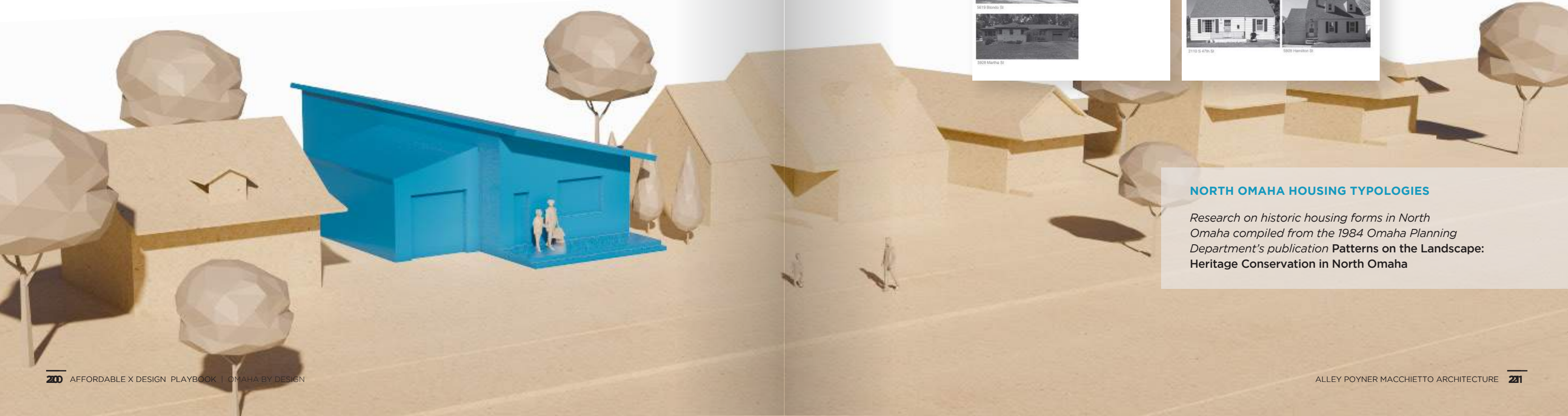
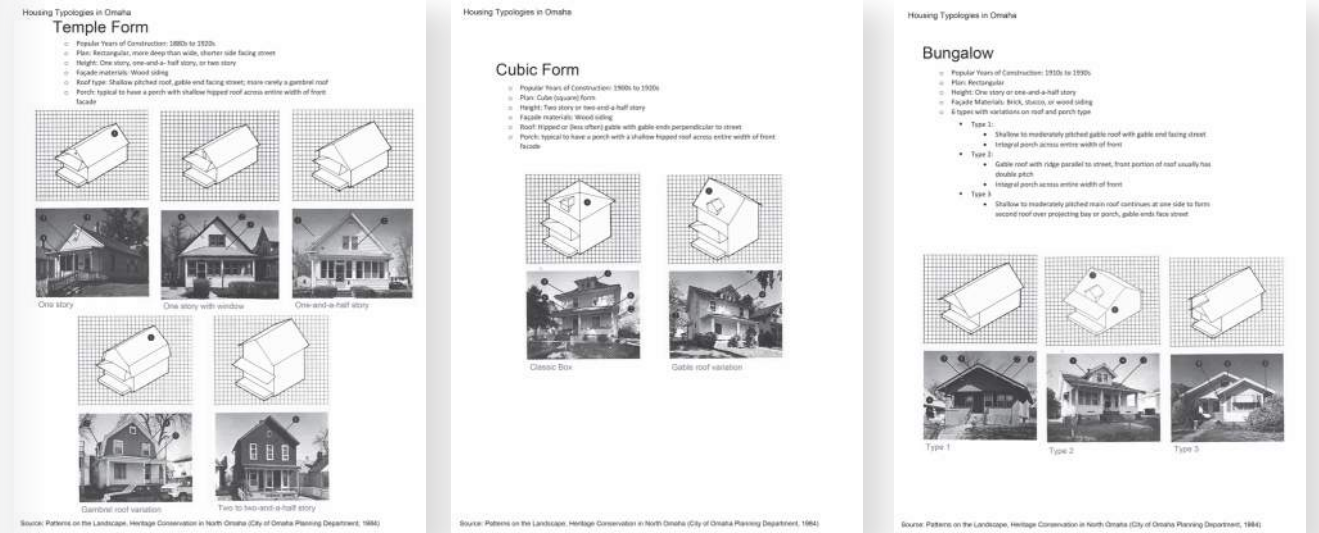
When designing an infill home, it is important to respond to the context of the existing neighborhood. This doesn't mean the house should mimic historic styles or be restricted by them, but rather that the new house should be appropriately scaled and take cues from existing homes.

With Highlander as the case study, we researched the existing housing stock within the area and created a sample neighborhood, shown below. In most older neighborhoods, the styles of the existing homes vary, so even if you want to build a more modern home, it can still be contextual if key elements are retained. These include a front porch or stoop, which help to create a transition space from the public street into the private home, while

also providing an opportunity for interaction with neighbors.

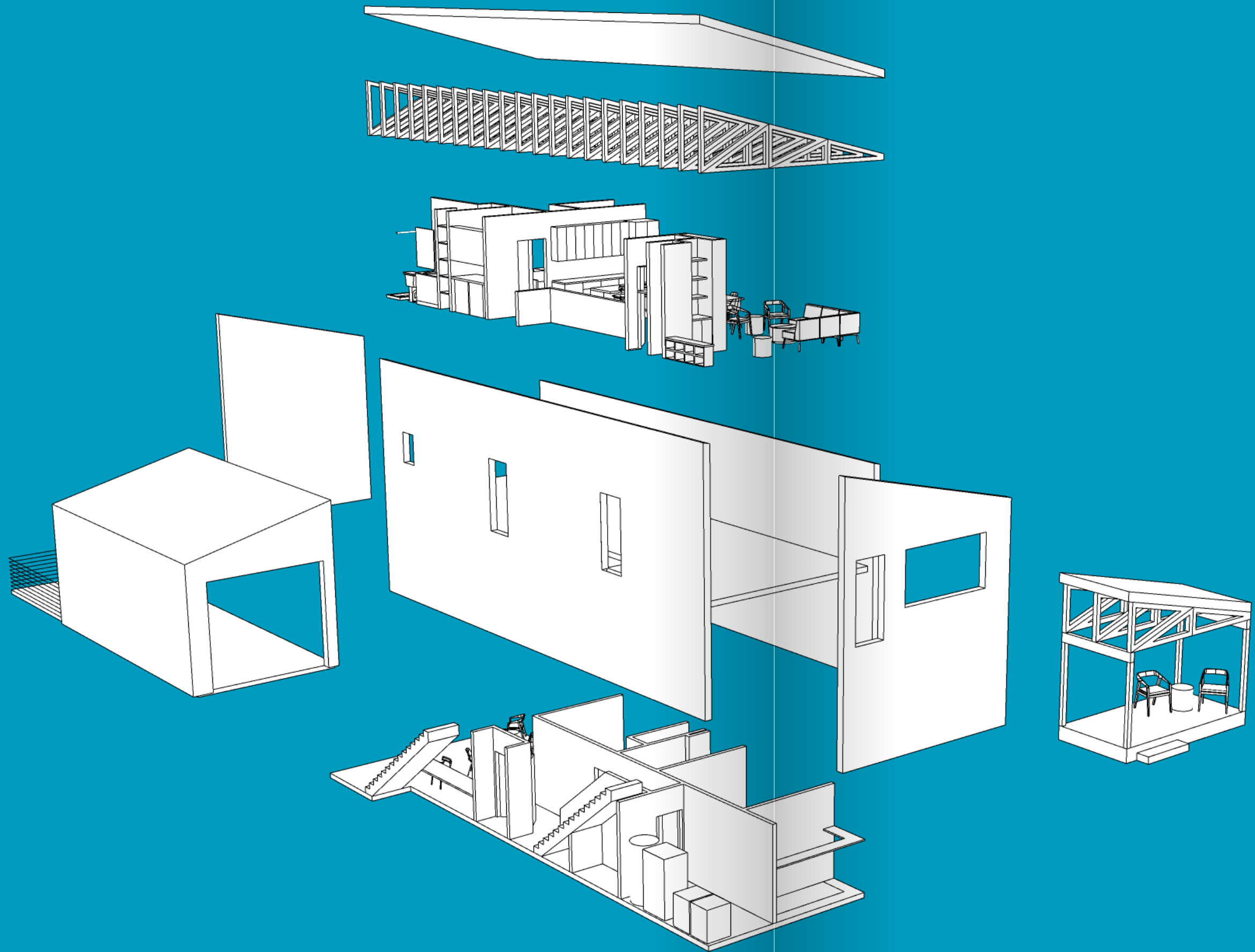
The size of the home is also important. Many older homes were built at a more intimate scale than you would find in most West Omaha subdivisions. Depending on your site's immediate neighbors, this may influence what type of house (one story or two, etc.) you would prefer to build.

Additional cues, such as roof forms, porch types, and decorative detailing can be used to make a home more contextual. Or, you can build on the eclecticism of older neighborhoods and develop a thoroughly modern home that adds to the variety and character of the city in a different way.



NORTH OMAHA HOUSING TYPOLOGIES

Research on historic housing forms in North Omaha compiled from the 1984 Omaha Planning Department's publication **Patterns on the Landscape: Heritage Conservation in North Omaha**



Design Concept

Design Concept

After stakeholder engagement, zoning research, and neighborhood context studies were complete, we started to develop the design concept. To kick this off, Omaha by Design, Seventy-Five North and Alley Poyner Macchietto held a design charrette. For many of us, this was one of our first in-person meetings after the first wave of the coronavirus pandemic, giving it special weight and excitement.

Our idea board is shown in the photographs below. The discussion resulted in the identification of four core principals:

“A House Should Look Like a House”

- Have a vernacular character
- Be “house shaped”
- Revolve around a modern hearth

Create Privacy Zones

- Site: public street, semi-public front yard, semi-private front porch, private home and backyard
- House: create zones and intuitive control points for visitors

Core Concept

- Centralize intensive uses (stairs, bathrooms, etc.) into a core system
- Create a simplified structural system

Kit of Parts/Modular/Customizable/Simple

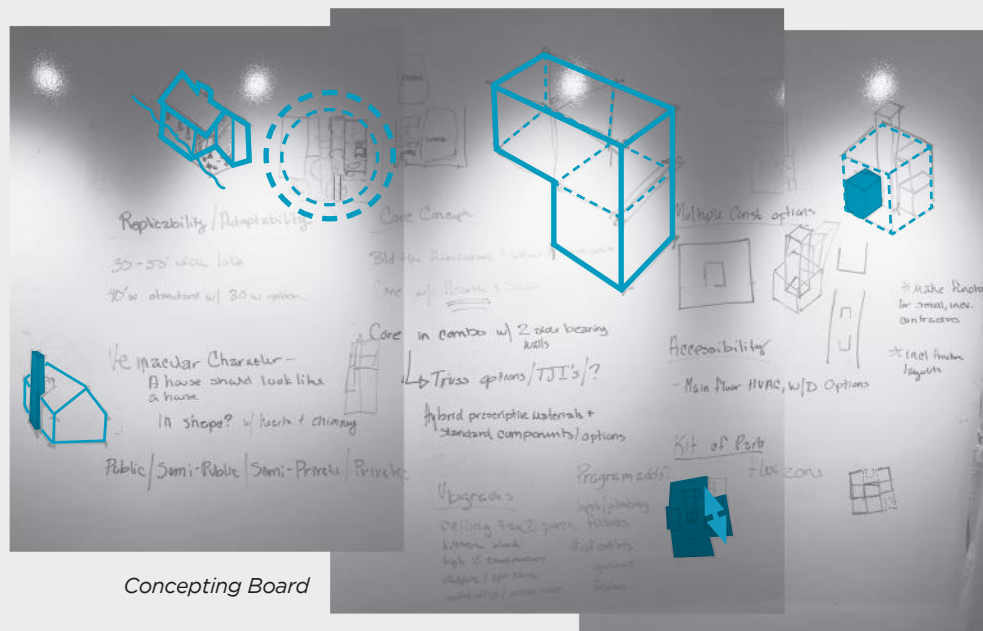
- Allow for variety in form and style, flexibility in size and configuration, and opportunities for owner input
- Use systems that can be constructed by small contractors or homeowners

Like the program on earlier pages, not all of these elements and concepts were realized in their original form, however they all influenced the final design concepts represented in this document.

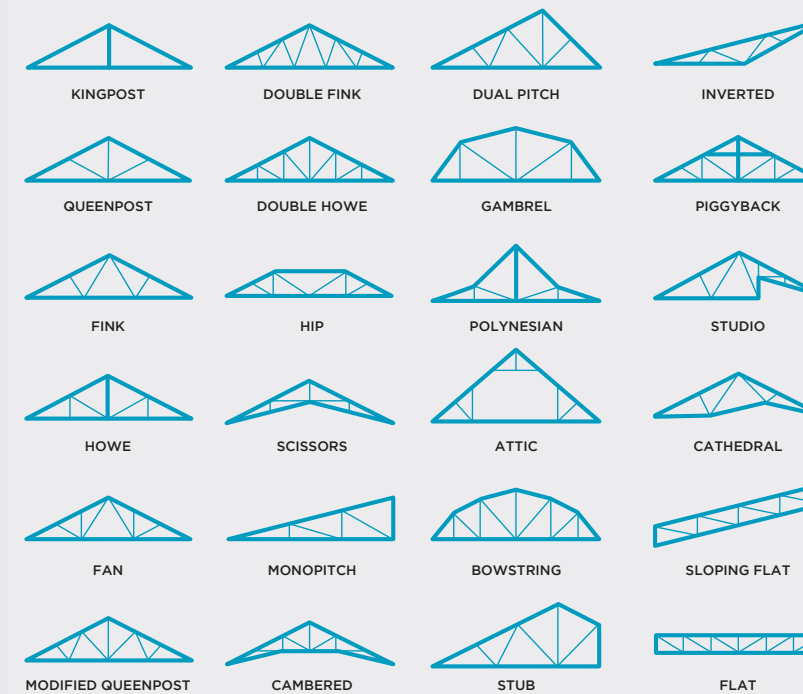
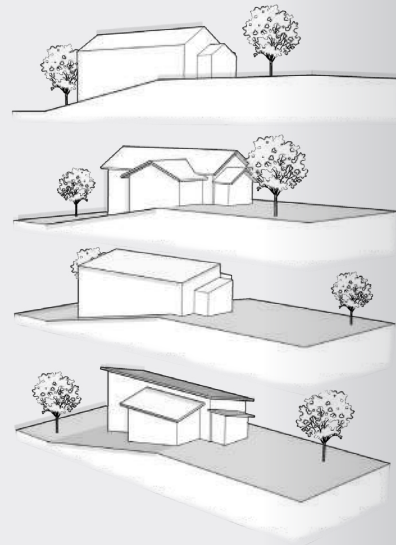
The basic framework we developed included simple, rectangular footprints - one for the

home and one for the garage - that can grow or shrink to accommodate the desired program. Additionally, the footprints can be extended to provide flexibility for future additions, allowing the home to be constructed in phases, which is particularly beneficial to homeowners performing some construction work themselves.

To provide for individual preference, variety can be realized through selection of a roof truss type, as shown below, and through other elements shown on the following pages.

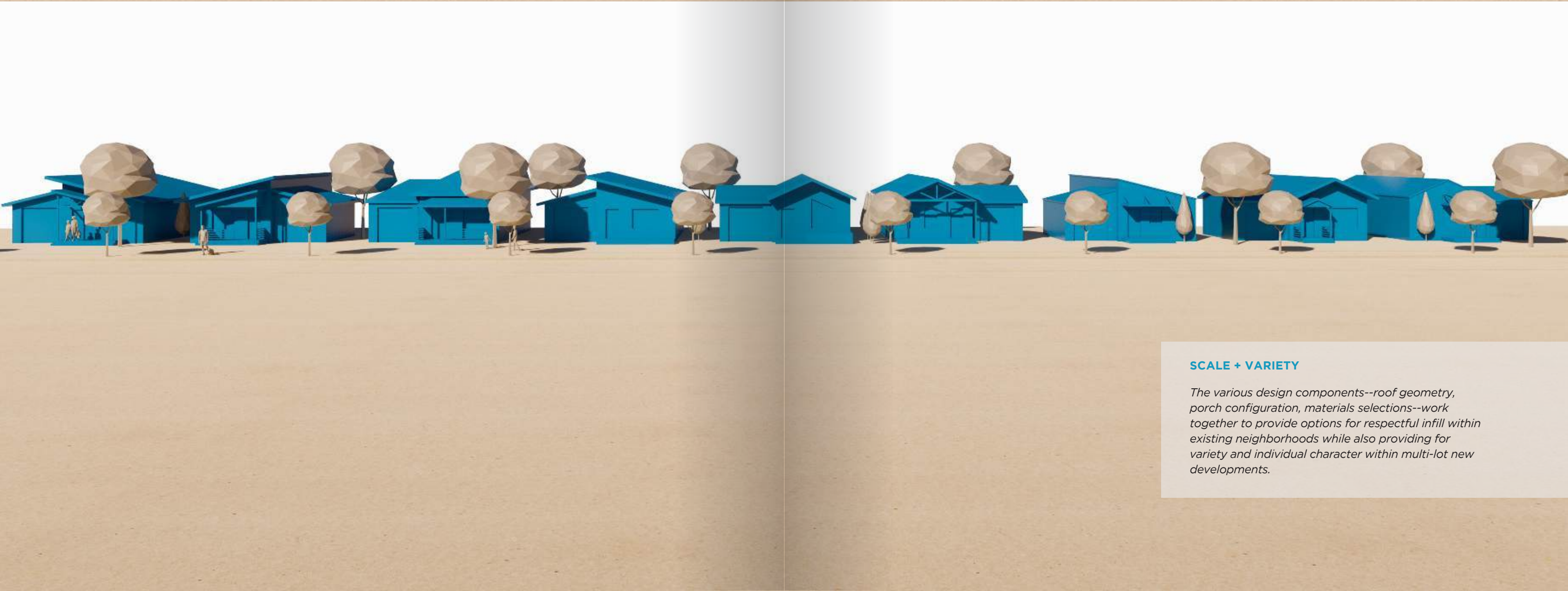
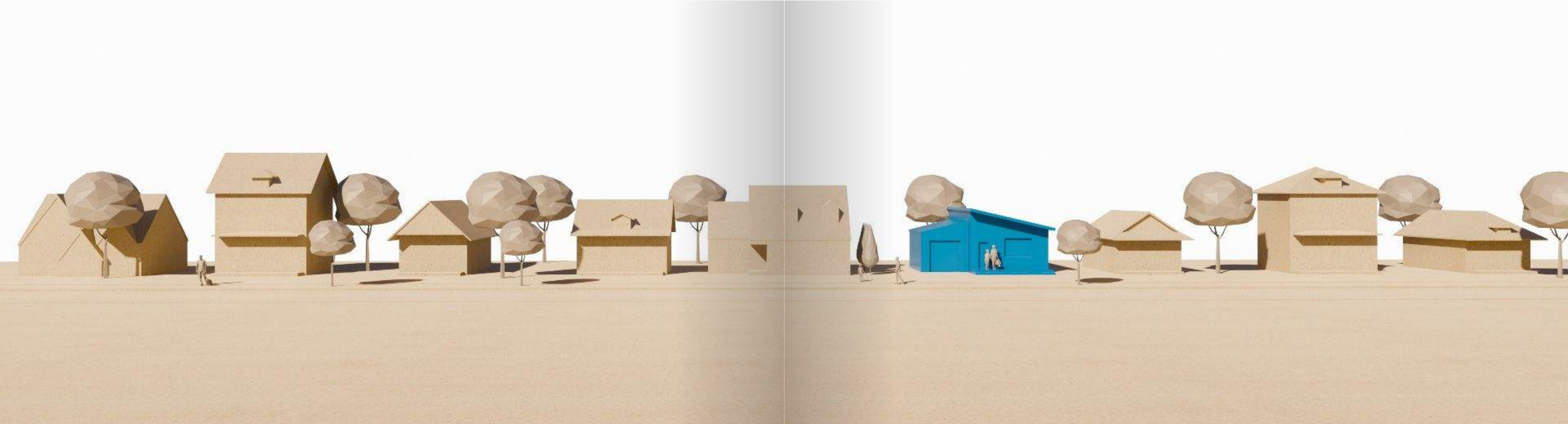


Concepting Board



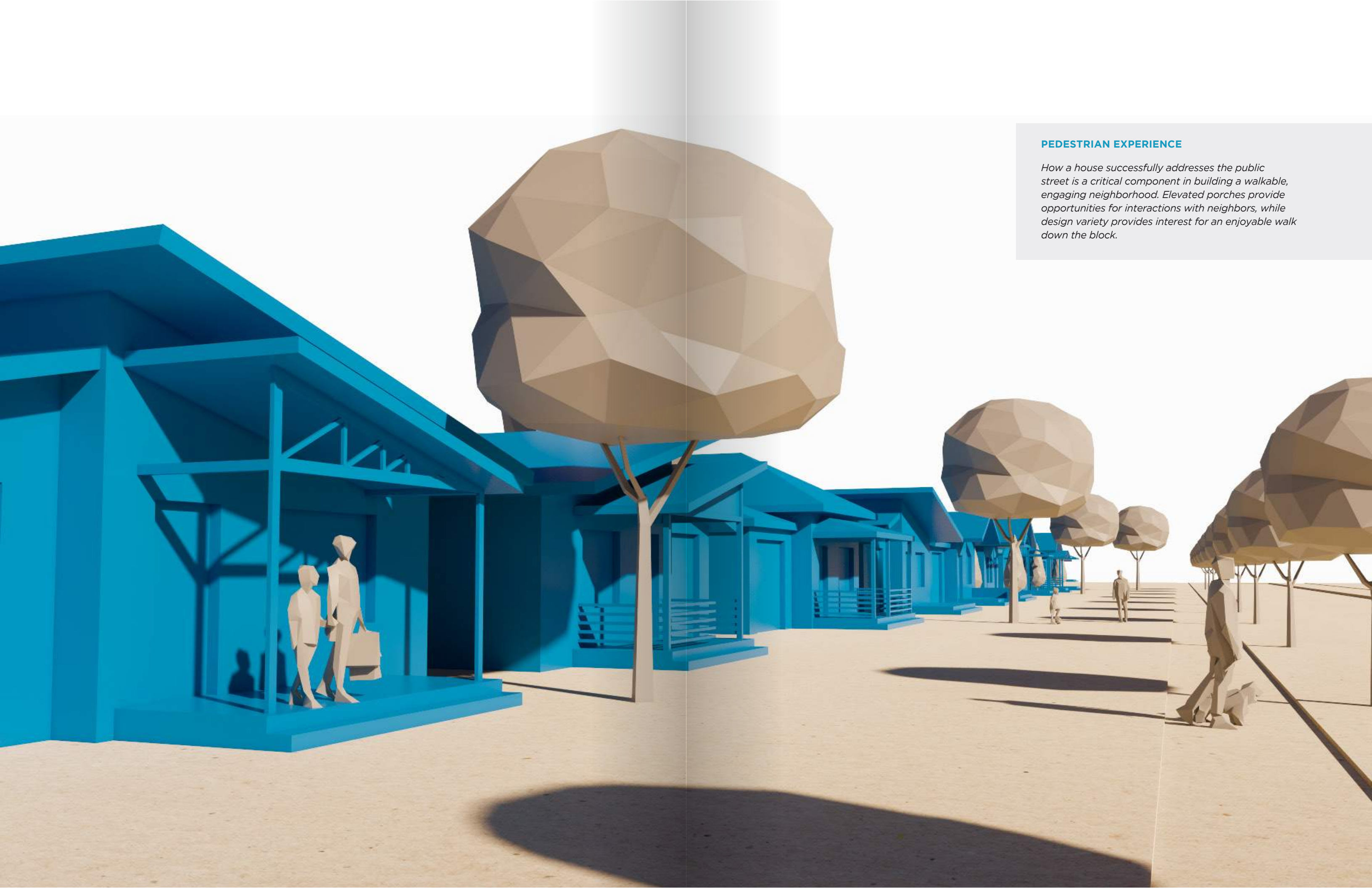
FORM

Because of the narrow width of typical available infill sites in east Omaha, the footprint of the house prototypes developed as a part of this study are quite narrow. This allows for the side walls of the homes to act as bearing walls for a variety of trusses. This single design decision allows for flexibility of the interior layout along with a multitude of forms - monopitch roofs for a more modern feel, gabled or even hip roofs for a more traditional shape. Scissor or cambered trusses create additional options within the interior of the home as well. Variety in overhang depths adds another design option, as shown in the diagrams on the opposite page.



SCALE + VARIETY

The various design components--roof geometry, porch configuration, materials selections--work together to provide options for respectful infill within existing neighborhoods while also providing for variety and individual character within multi-lot new developments.



PEDESTRIAN EXPERIENCE

How a house successfully addresses the public street is a critical component in building a walkable, engaging neighborhood. Elevated porches provide opportunities for interactions with neighbors, while design variety provides interest for an enjoyable walk down the block.

Design Concept *continued*

The conceptual design's plans are organized around three primary components, described below. Organizing the homes around these three areas is intended to maximize usable space, and minimize inefficiencies by doing simple things such as consolidating and stacking plumbing into a few proximate areas.

These are intended as an organizing framework, not a prescriptive solution to all floor plans, and as such not all plans adhere strictly to them. We aimed to use the framework in most conditions, but strategically varied from it where it increased the quality of the design.

Service Spaces

The service spaces, including circulation and storage, are located on the west wall of the home, aligned with the front door. This consolidates these uses along the shared wall with the garage, maximizing window opportunities within the living spaces on the east half of the plan.

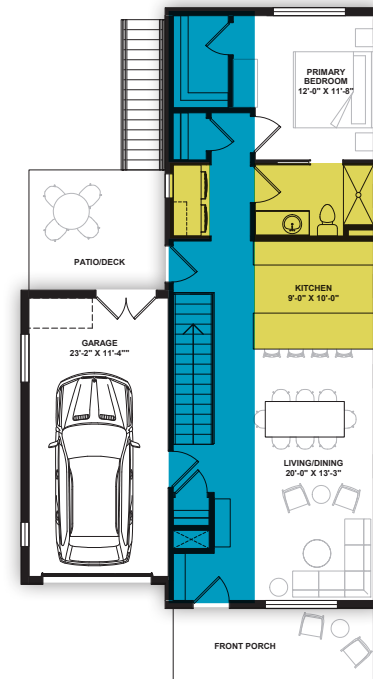
Plumbed Areas

Stacking and consolidating the plumbed areas (bathrooms, laundry, kitchens) reduces the amount of piping required in a home, while also simplifying future maintenance.

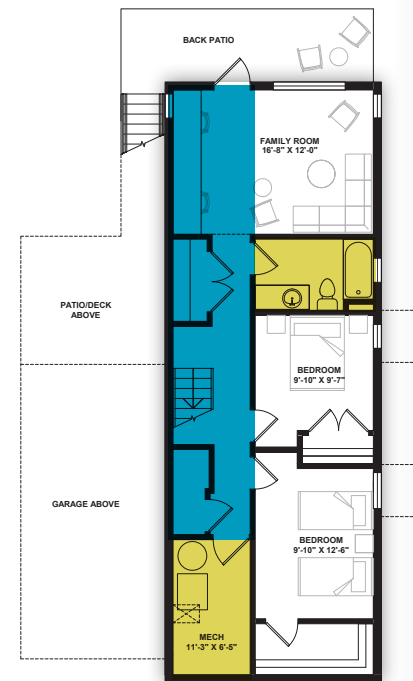
Served Spaces

Organizing the service and plumbed areas as outlined above provides flexibility to the remaining spaces - the "served" spaces. These living areas, such as living and family rooms and bedrooms, can be organized based upon the preferences and needs of the individual homeowner. For example, on the lower level of the Walk Out option shown to the right, the number and size of bedrooms and living spaces could be adjusted within areas in white.

Walk Out Basement Concept

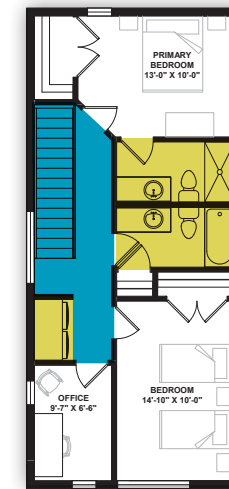


Main Level

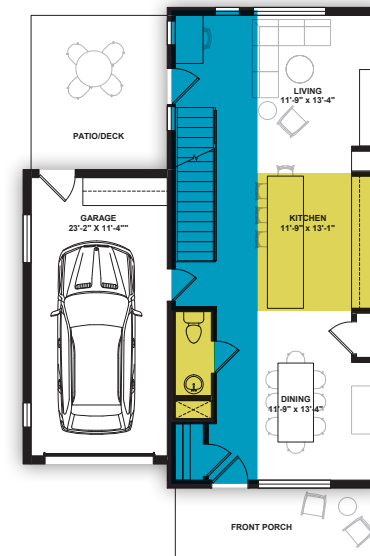


Basement

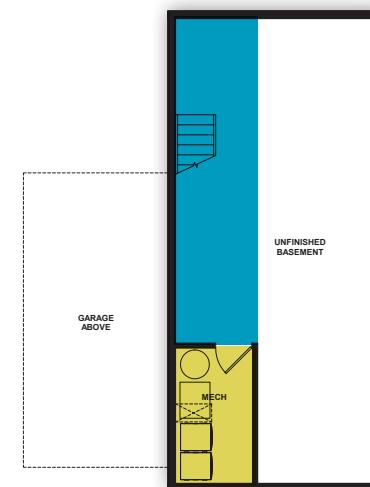
Two Story Concept w/ Unfinished Basement



Upper Level

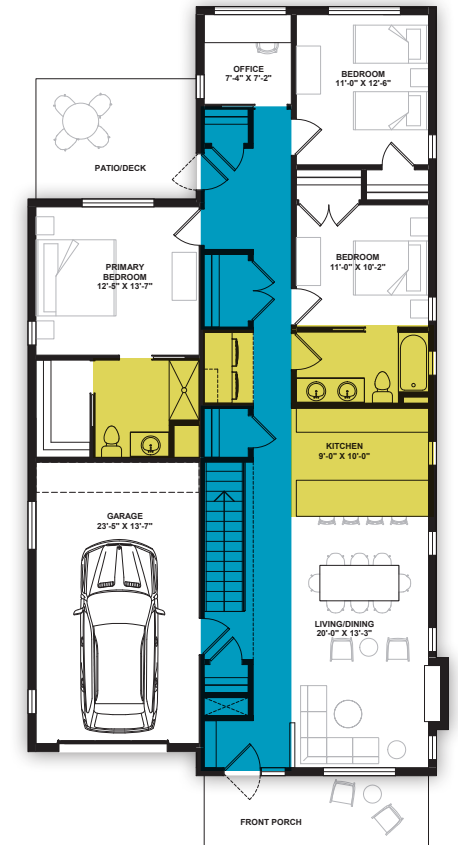


Main Level

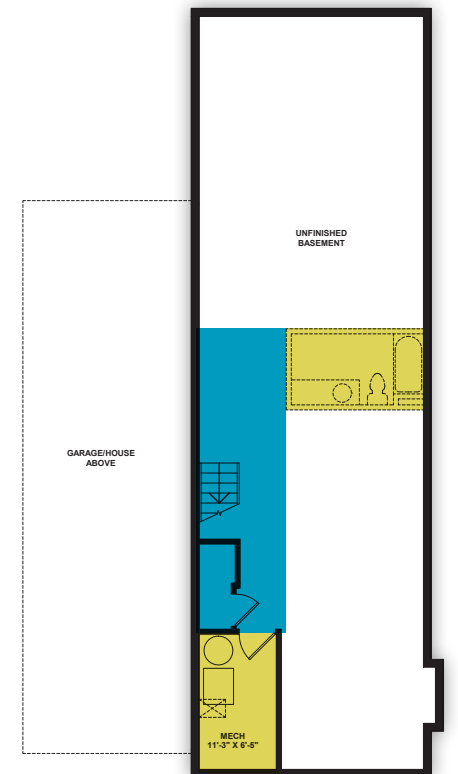


Basement

One Story Concept w/ Unfinished Basement



Main Level

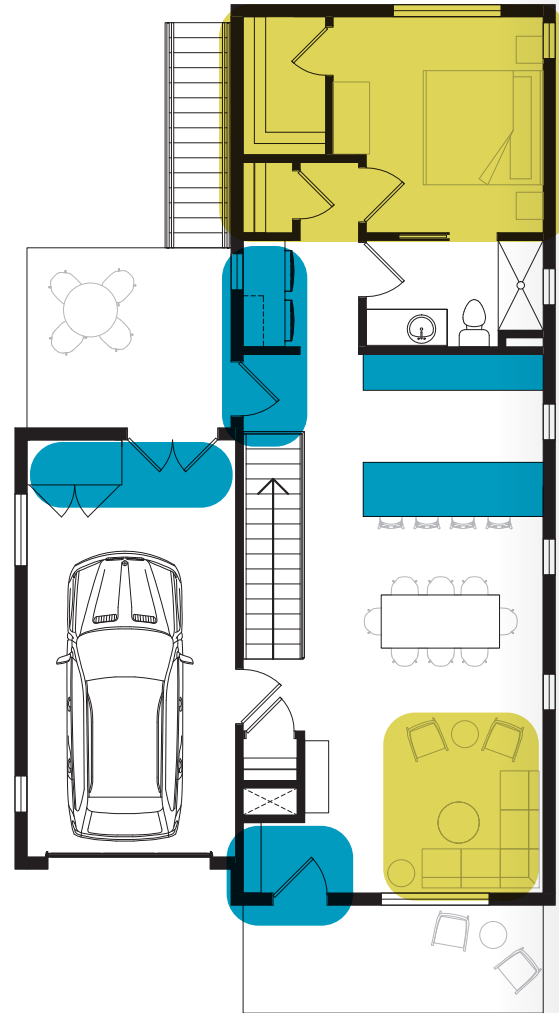


Basement

Design Concept *continued*

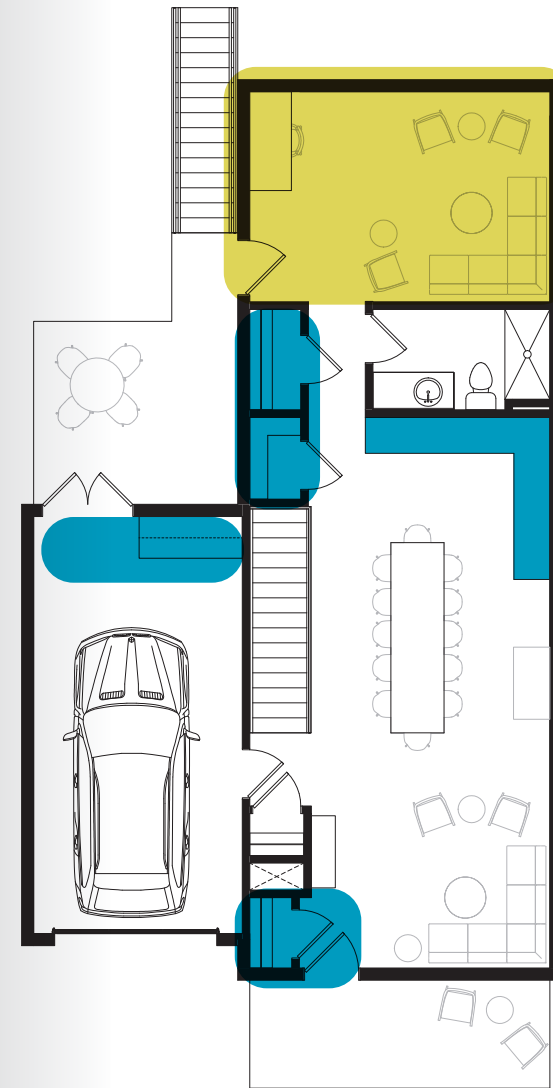
Within all of the area types outlined on the previous page, individual components can be swapped in and out to respond to the needs of the homeowner. For example, on Plan Example 1, the kitchen is laid out as a two-sided galley, with a seated bar area. This is a very popular kitchen configuration, but doesn't allow for a larger dining table. The second plan example provides an alternative L-shaped kitchen in the same base plan, allowing for a large dining table to accommodate bigger family gatherings.

Plan Example 1 also provides a primary bedroom on the main level - a great feature for those with mobility concerns or those who are planning to age in place. Plan Example 2 shows a family room in the same location. This could be a great option for younger families who want all of their living spaces on one level, and all of the bedrooms on another, while still providing the opportunity to convert it into a primary bedroom once the home's residents age or if a member of the family experiences reduced mobility.



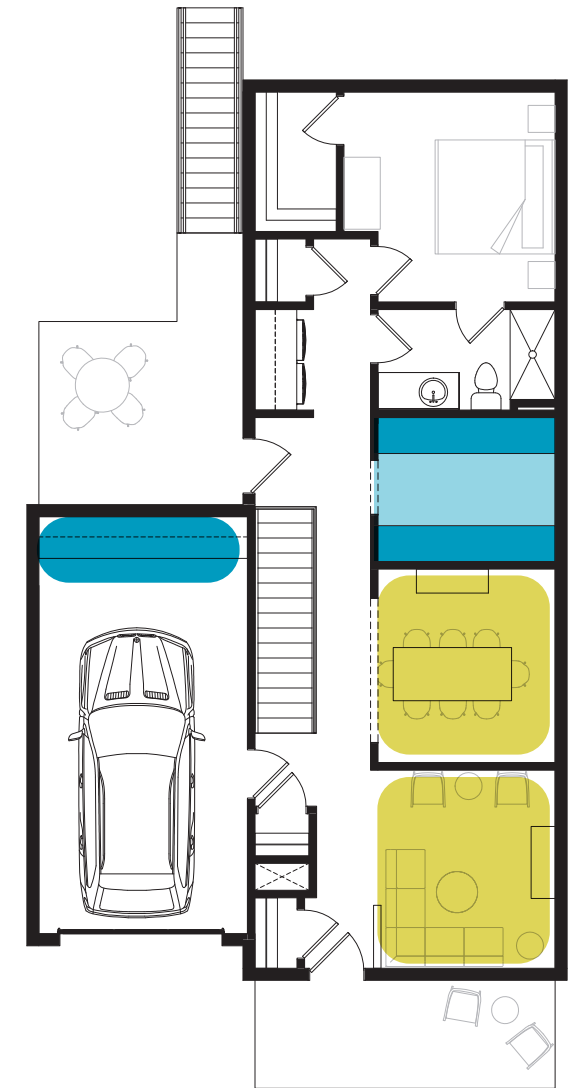
Plan Example 1

- Main-Level Primary Bedroom*
- Two-Sided Galley Kitchen*
- Main-Level Laundry*
- Drop Area Casework at Front Door*
- Garage Access to Patio w/ Tall Storage*



Plan Example 2

- Main-Level Family Room at Back*
- L-Shaped Kitchen*
- Lower-Level Laundry/Additional Main-Level Closet*
- Closet at Front Door*
- Garage Access to Patio w/ Work Bench*

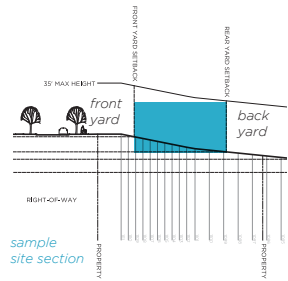


Plan Example 3

- Enclosed Kitchen*
- Enclosed Dining Room*
- Screen Wall Between Front Door and Living Room*
- Work Bench in Garage w/ No Patio Access*

Design Concept *continued*

The Burdette



3 Bed/2 Bath Walk-Out Basement on a Narrow Lot
Primary Bedroom and Laundry on Main Level

| | |
|--------------|----------------|
| Main Level | 900 sf |
| Basement | 900 sf |
| Total | 1800 sf |

Garage 295 sf

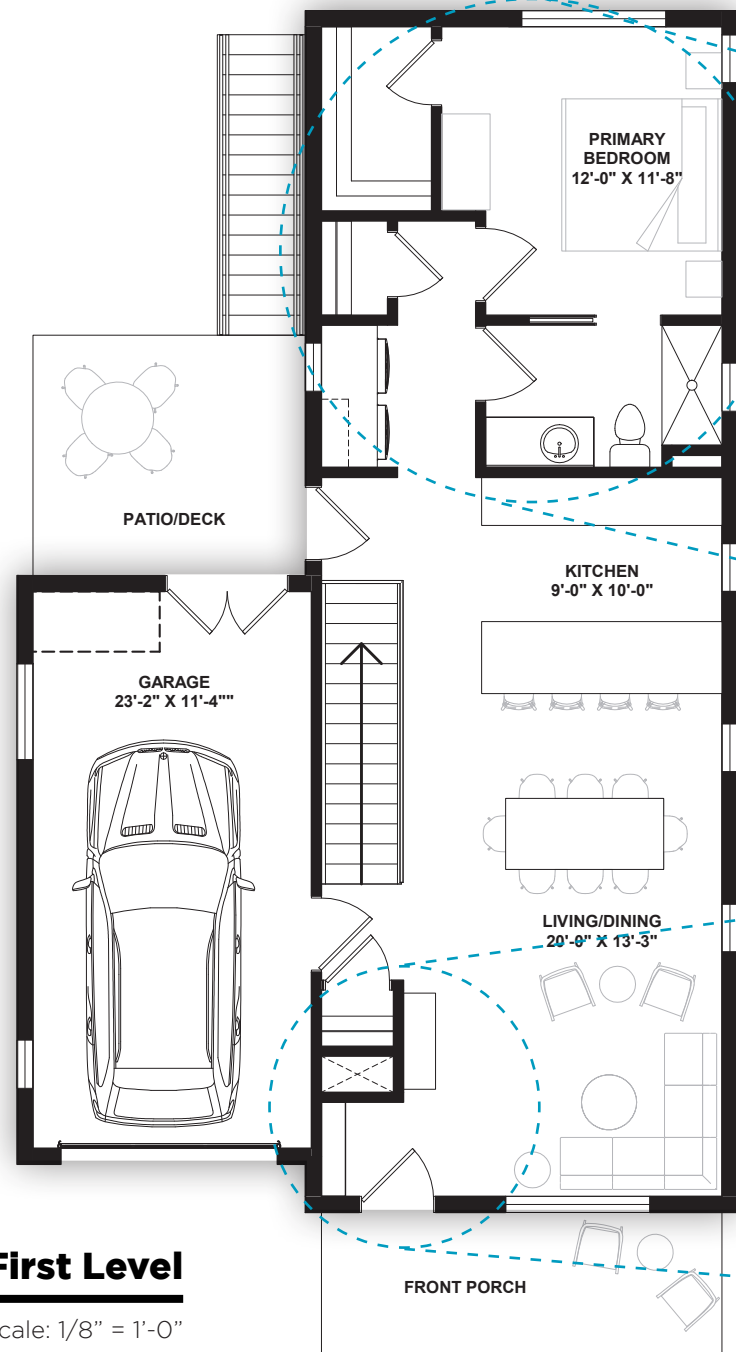
Notes:
Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.

Elevations shown on later pages.

Dimensioned and noted plans are included in the appendix of this document.

First Level

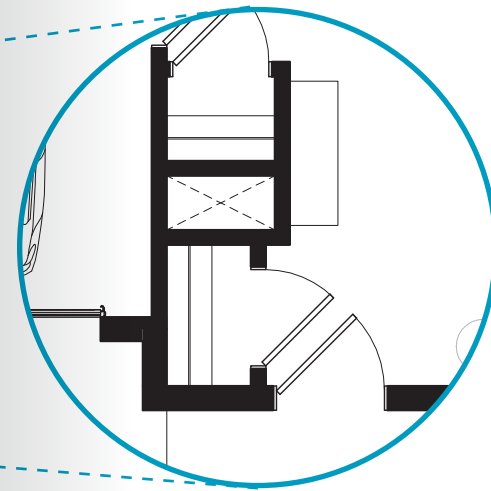
scale: 1/8" = 1'-0"



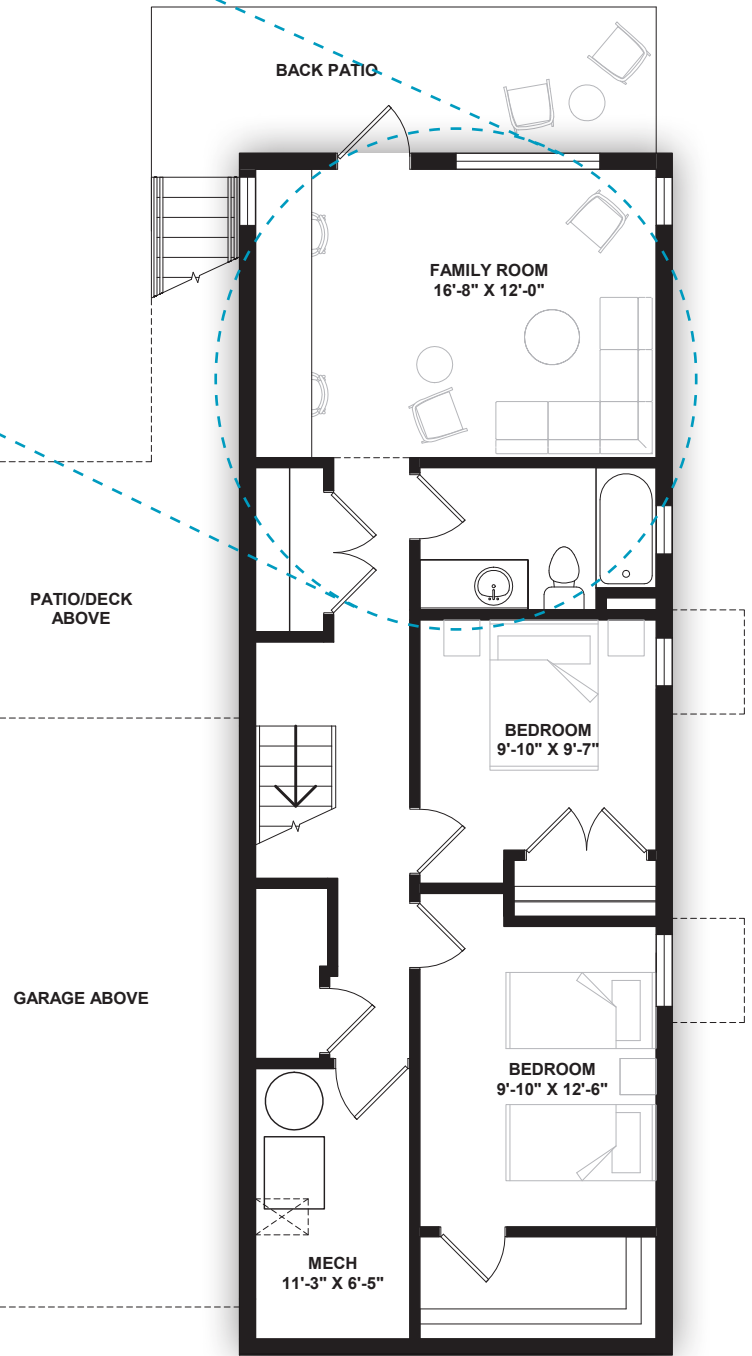
Alternative Basement Bedroom/Study Space



Alternative Main Level Family Room Layout



Alternative Entry Layout w/ Closet



Basement

scale: 1/8" = 1'-0"

Design Concept *continued*

The Parker

3 Bed/2 Bath Single Story Home w/ Optional Basement on Typical Lot (50')

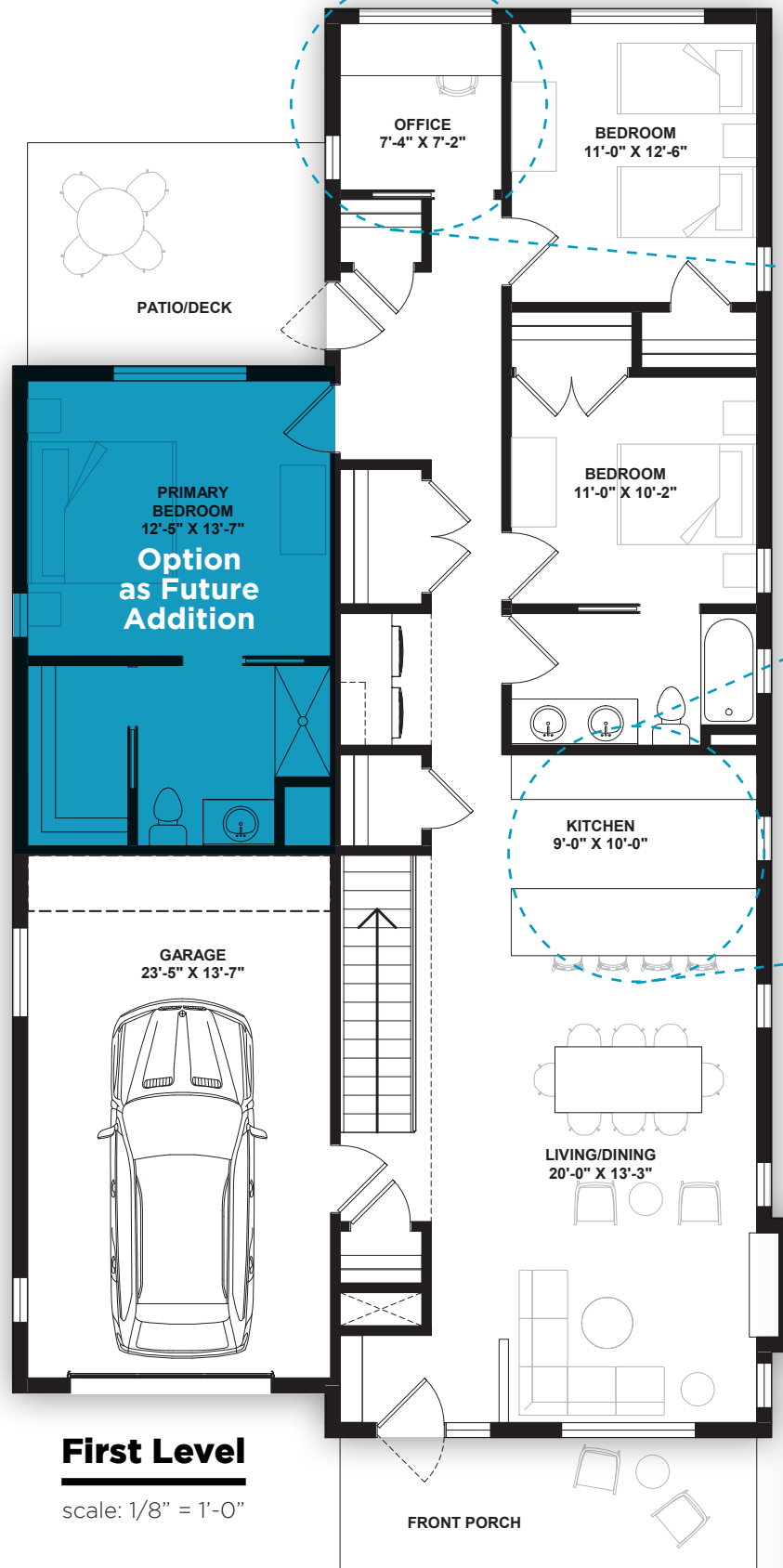
Main Level 1592 sf
Basement 1286 sf
Total 2878 sf

Garage 343 sf

Area shown blue could be built as a future addition.

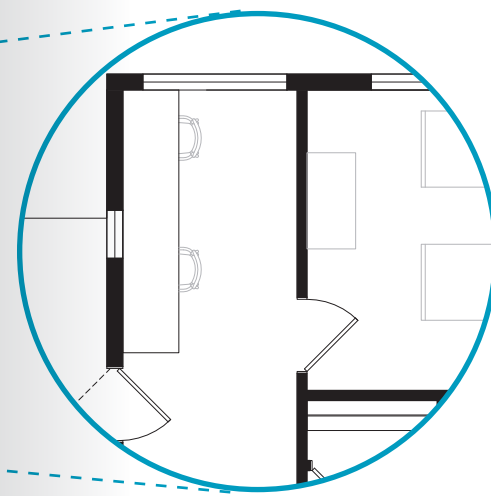
Elevations shown on later pages.

Dimensioned and noted plans are included in the appendix of this document.

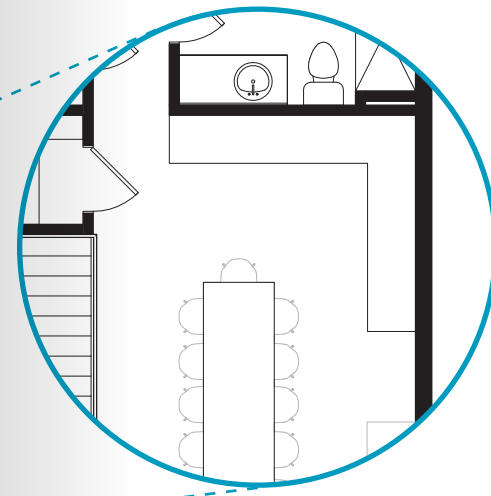


First Level

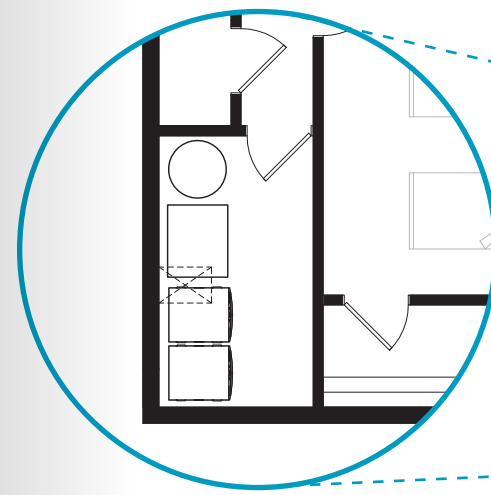
scale: 1/8" = 1'-0"



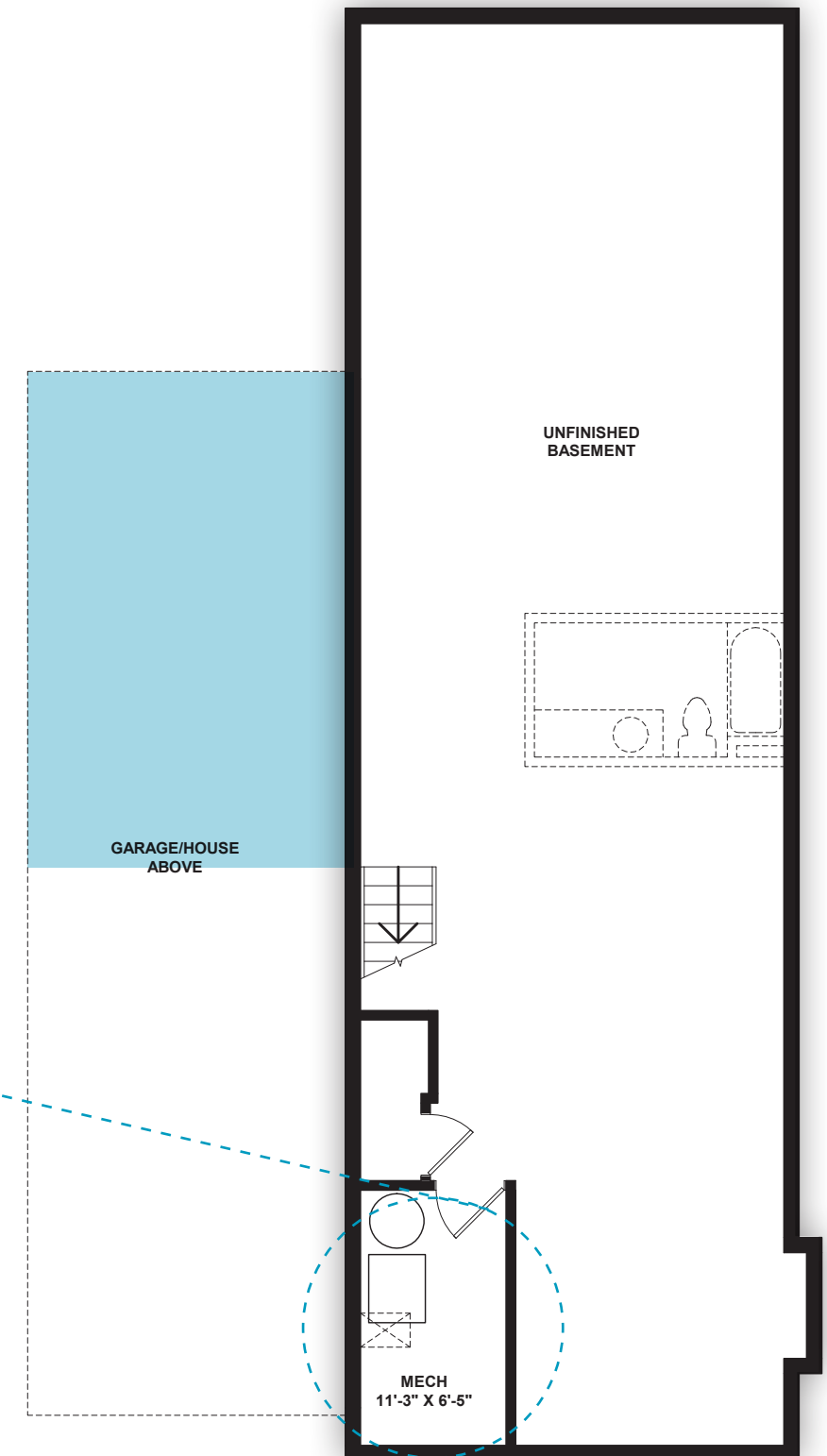
Alternative Open Office/
Study Area Layout



Alternative Kitchen
Layout



Alternative Basement
Laundry Location



Basement

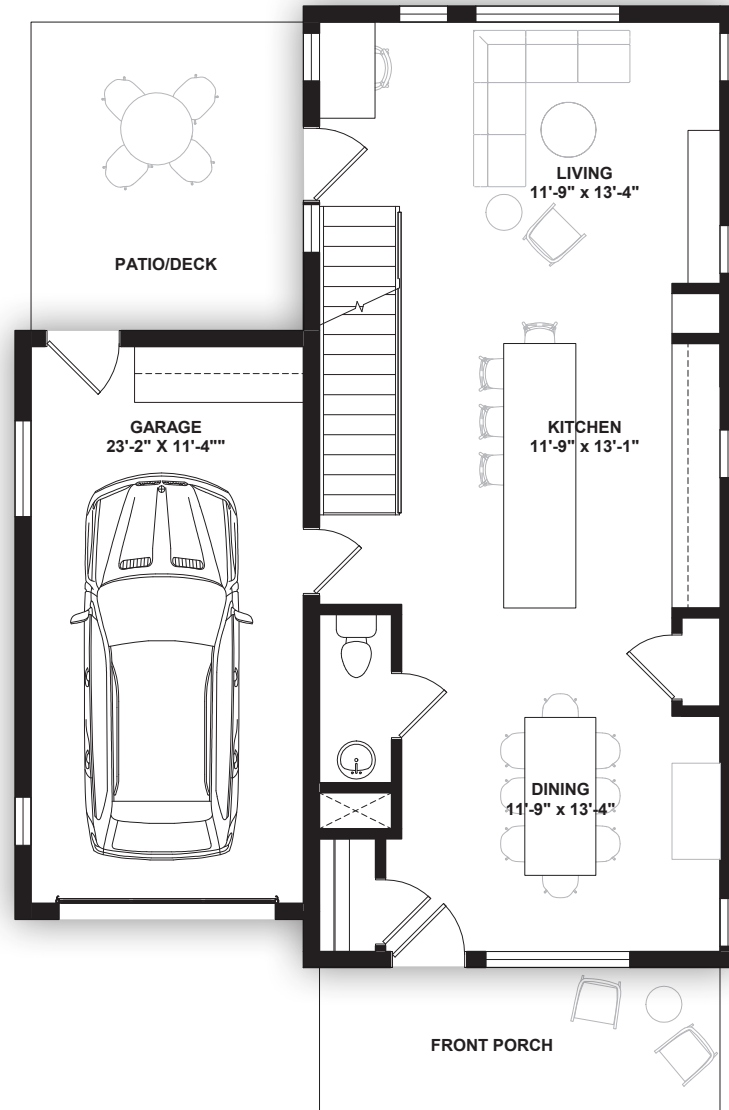
scale: 1/8" = 1'-0"

Design Concept *continued*

The Patrick

2 Bed/2.5 Bath Two-Story Home w/ Optional Basement on Narrow Lot (40')

| | |
|--------------|----------------|
| Main Level | 720 sf |
| Upstairs | 720 sf |
| Basement | 720 sf |
| Total | 2160 sf |
| Garage | 295 sf |

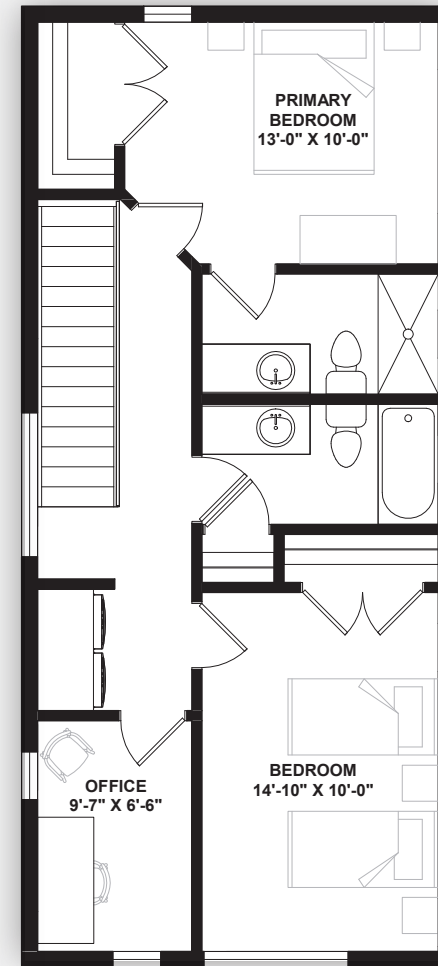


First Level

scale: 1/8" = 1'-0"

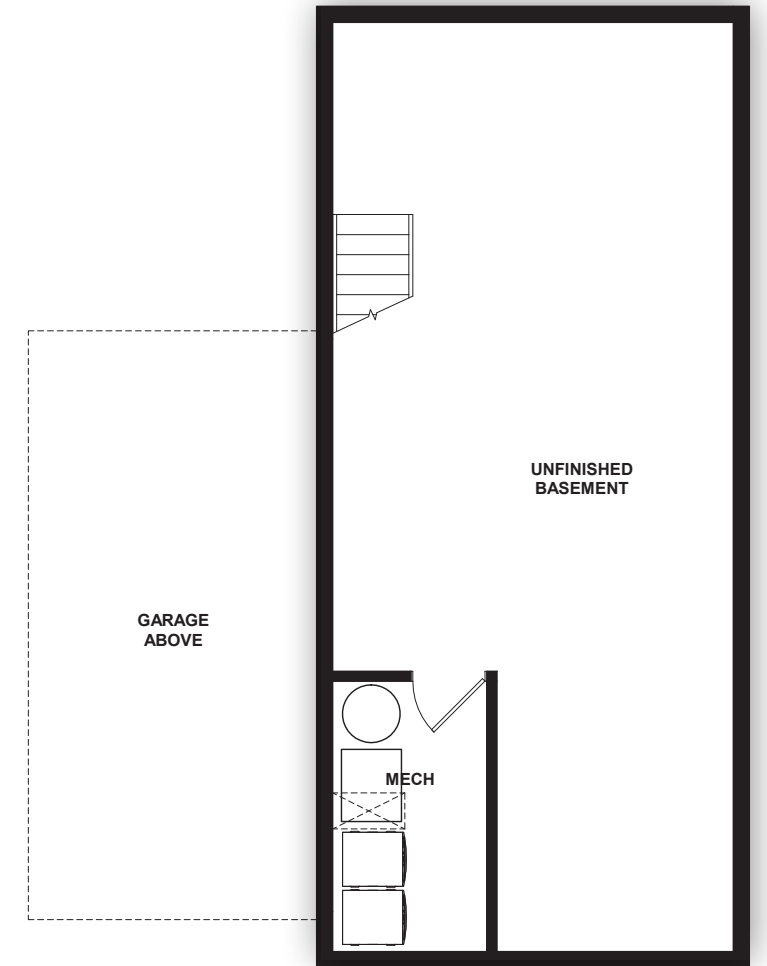
Elevations shown on later pages.

Dimensioned and noted plans are included in the appendix of this document.



Second Level

scale: 1/8" = 1'-0"



Basement

scale: 1/8" = 1'-0"

Design Concept *continued*

The Patrick

Alternate 1 - No Basement

2 Bed/2.5 Bath Two-Story Home w/ NO Basement on Narrow Lot (40')

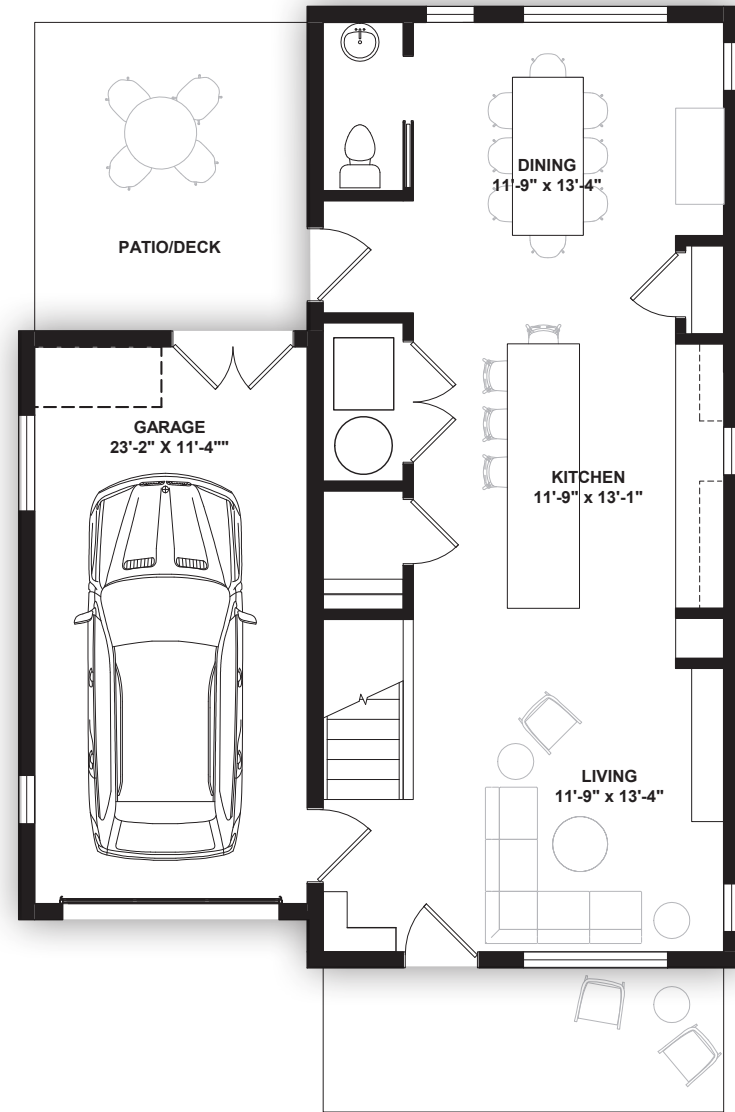
Main Level 720 sf
 Upstairs 720 sf
Total 1440 sf

Garage 295 sf

Assumes interior bathroom would be reinforced for storm protection.

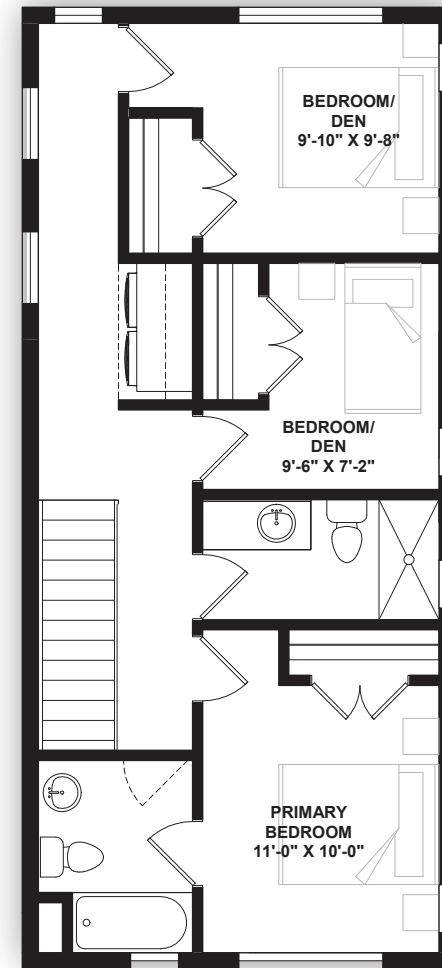
Elevations shown on later pages.

Dimensioned and noted plans are included in the appendix of this document.



First Level

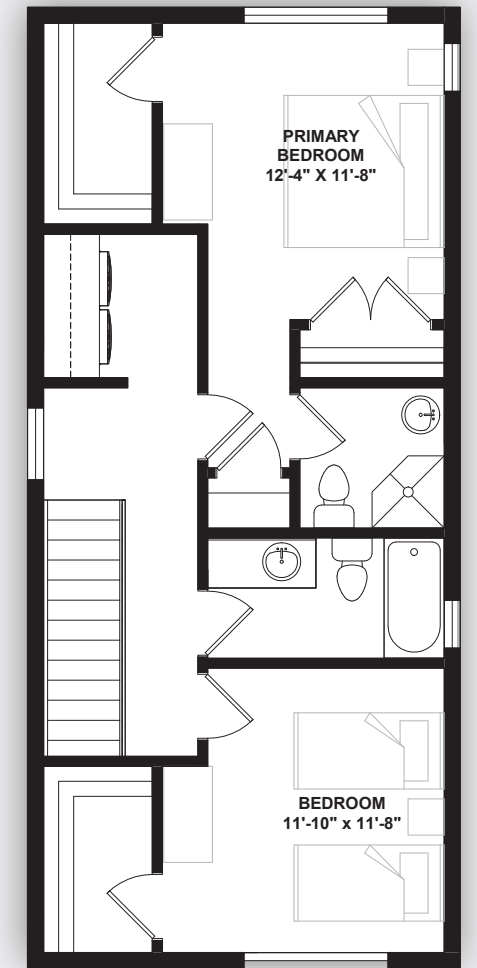
scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"

Alternate Upper Level



Second Level

scale: 1/8" = 1'-0"

Design Concept *continued*

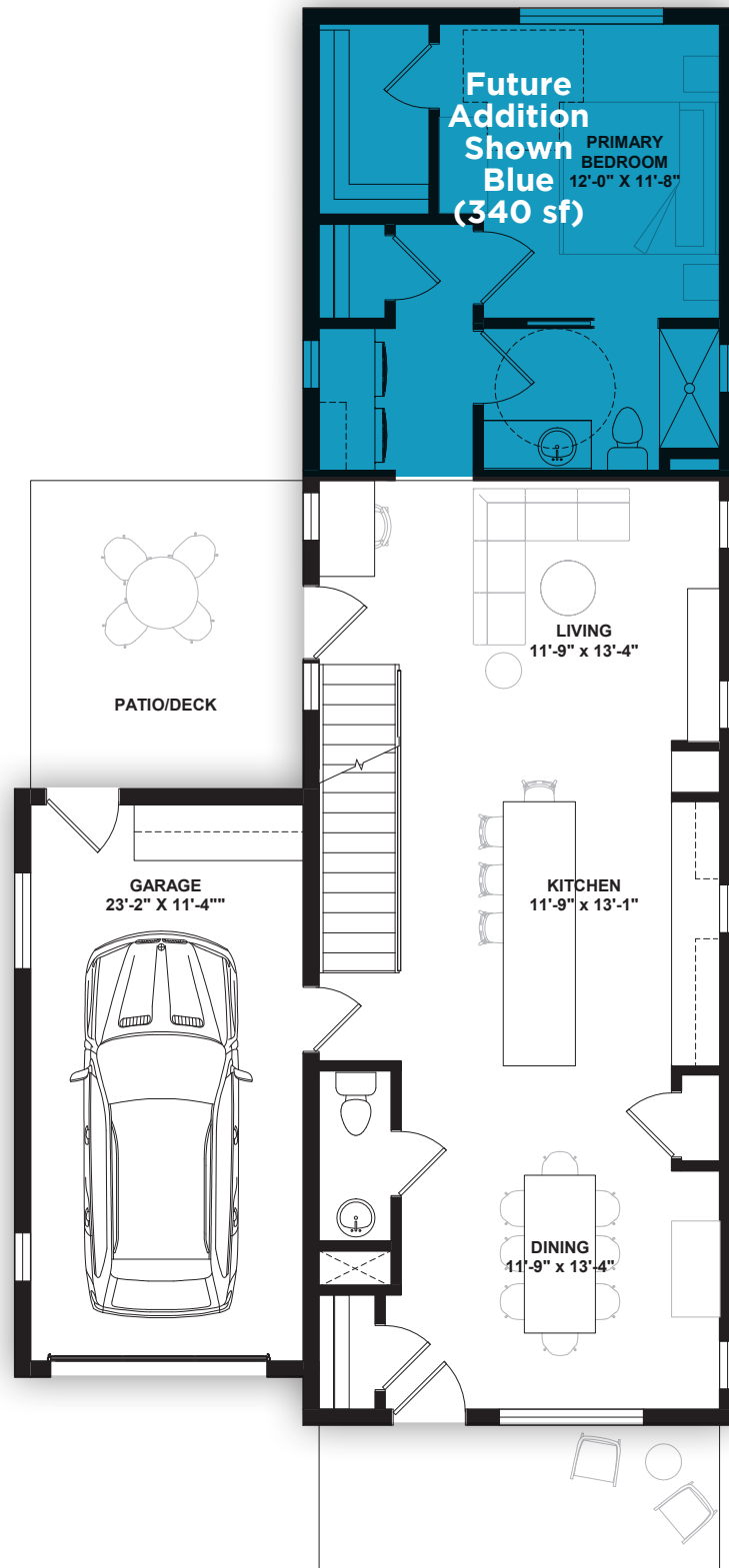
The Patrick Alternate 2 - Future Addition of Main Level Primary Bedroom

3 Bed/3.5 Bath Two-Story
Home w/ Basement on
Narrow Lot (40')

*Example of how a main-level
primary bedroom can be added in
a future phase.*

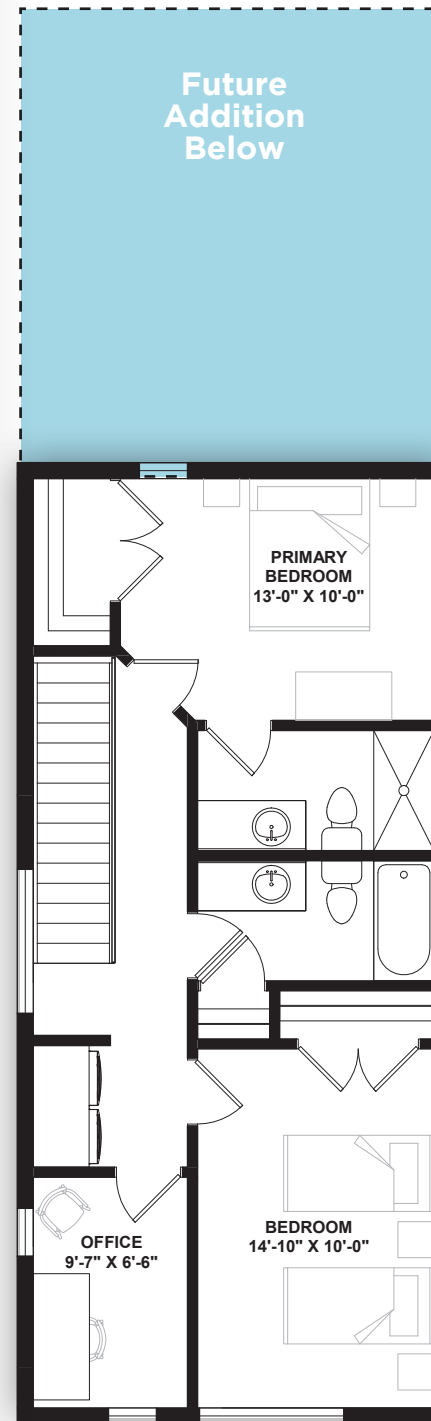
Main Level 1060 sf
(with addition)
Upstairs 720 sf
Basement 720 sf
Total 2,200 sf

Garage 295 sf



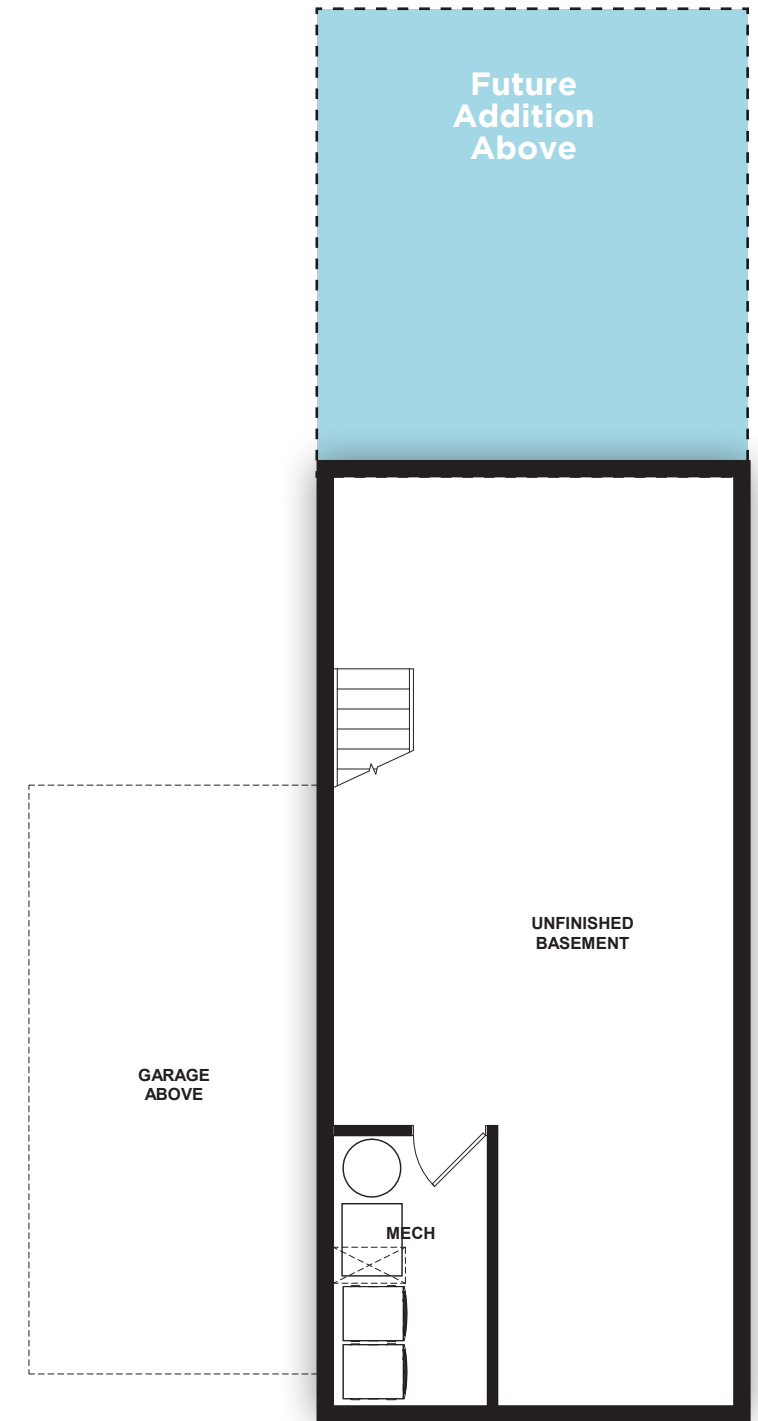
First Level

scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"

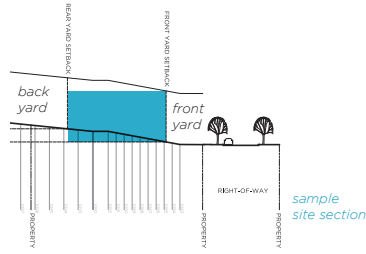


Basement

scale: 1/8" = 1'-0"

Design Concept *continued*

The Blondo

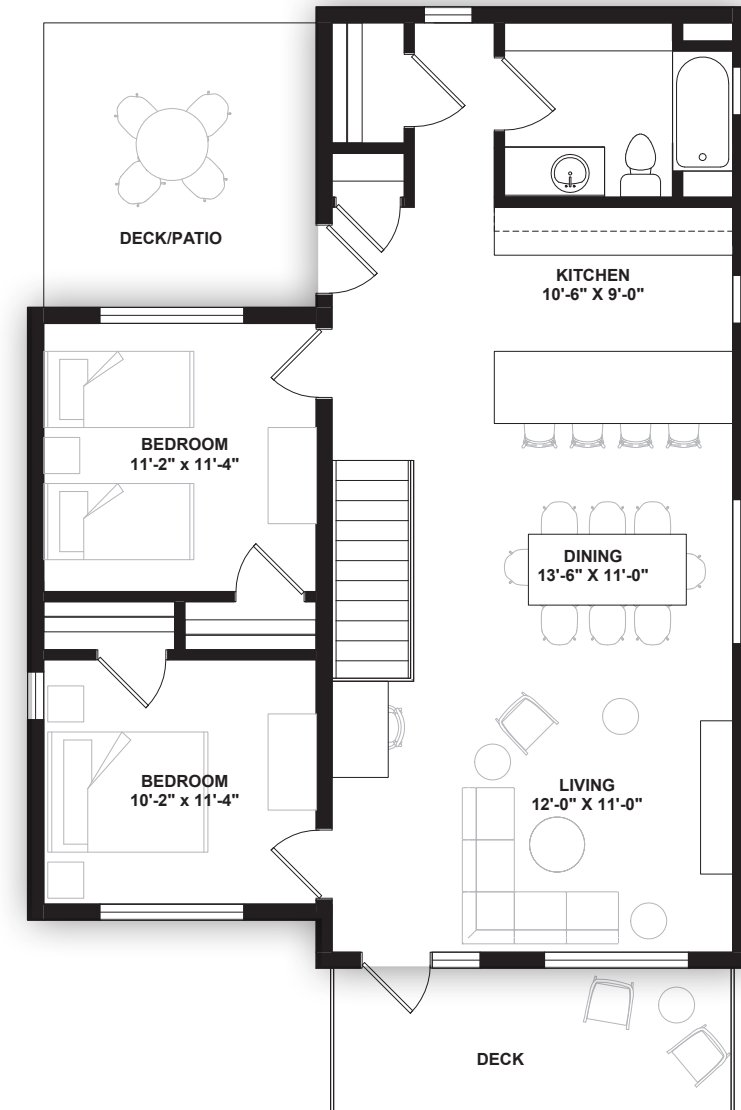
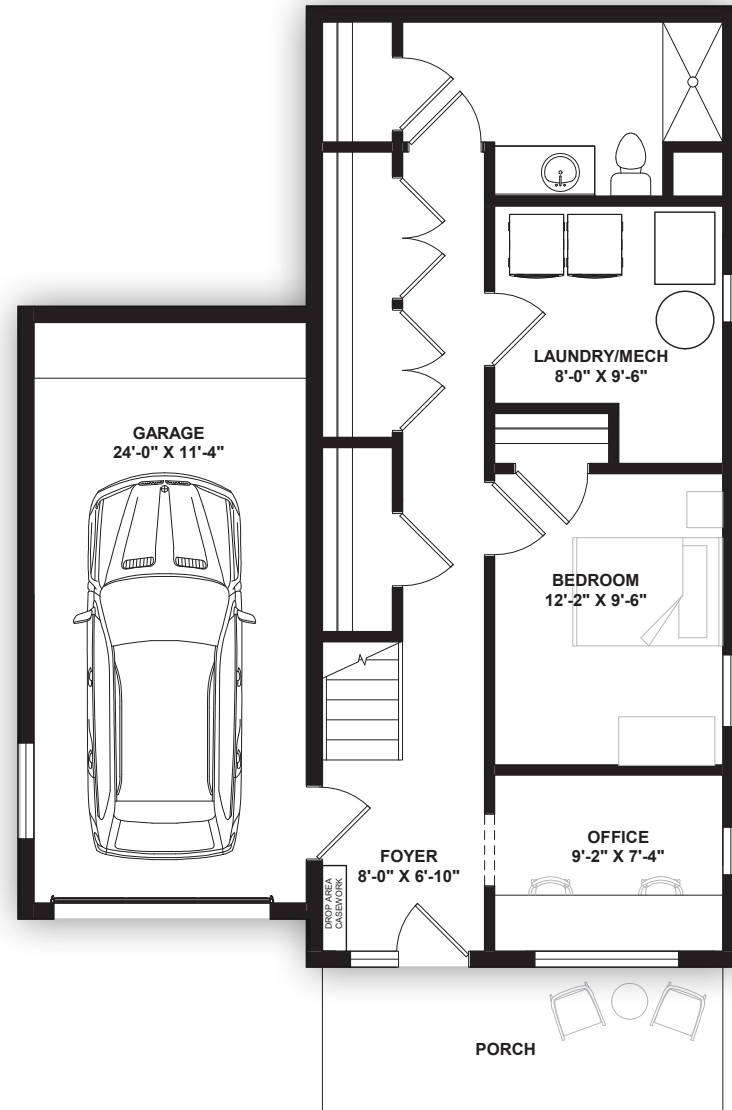


“Walk-In Basement”
 3 Bed/2 Bath Home w/
 Office on Narrow Lot (40’)
This plan is for homes that are built-into a hill because of site topography.

Main Level 720 sf
 Upstairs 1,026 sf
Total 1,746 sf

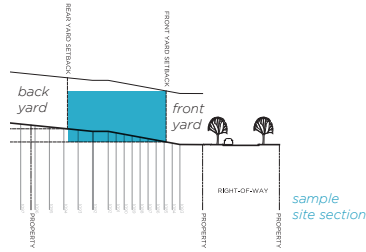
Garage 306 sf

Notes:
 Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.



Design Concept *continued*

The Blondo Alternate 1 - Partially Enclosed Kitchen

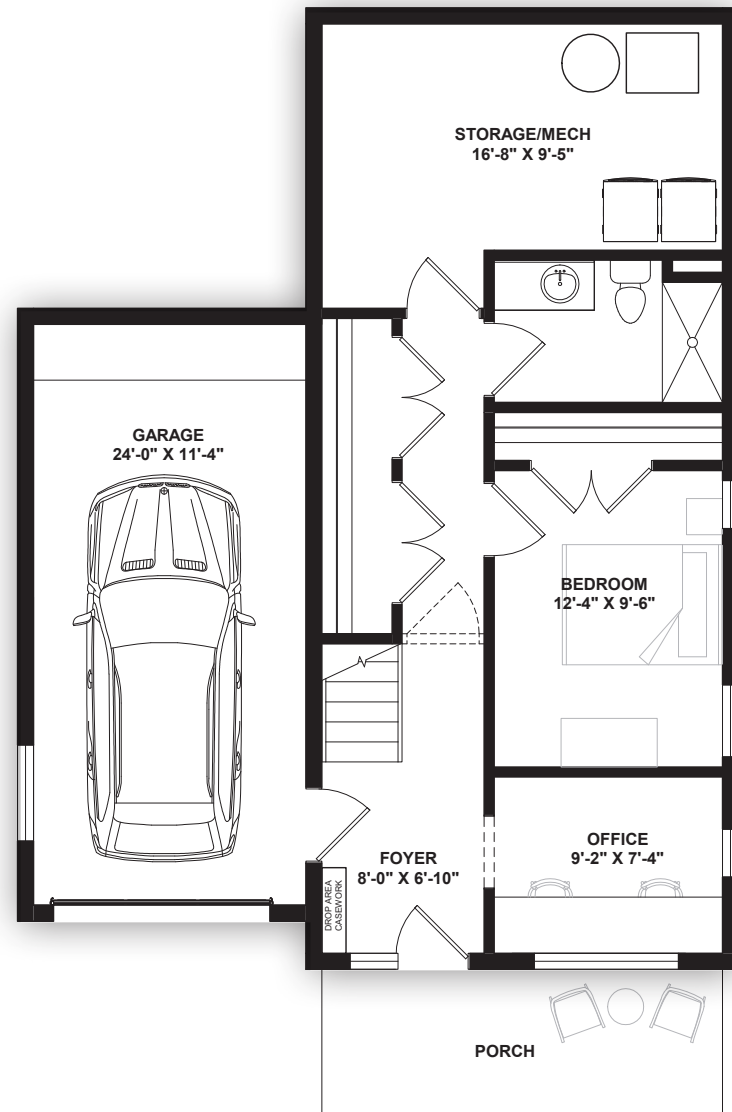


“Walk-In Basement”
3 Bed/2 Bath Home w/
Office on Narrow Lot (40’)
This plan is for homes that are built-into a hill because of site topography.

Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

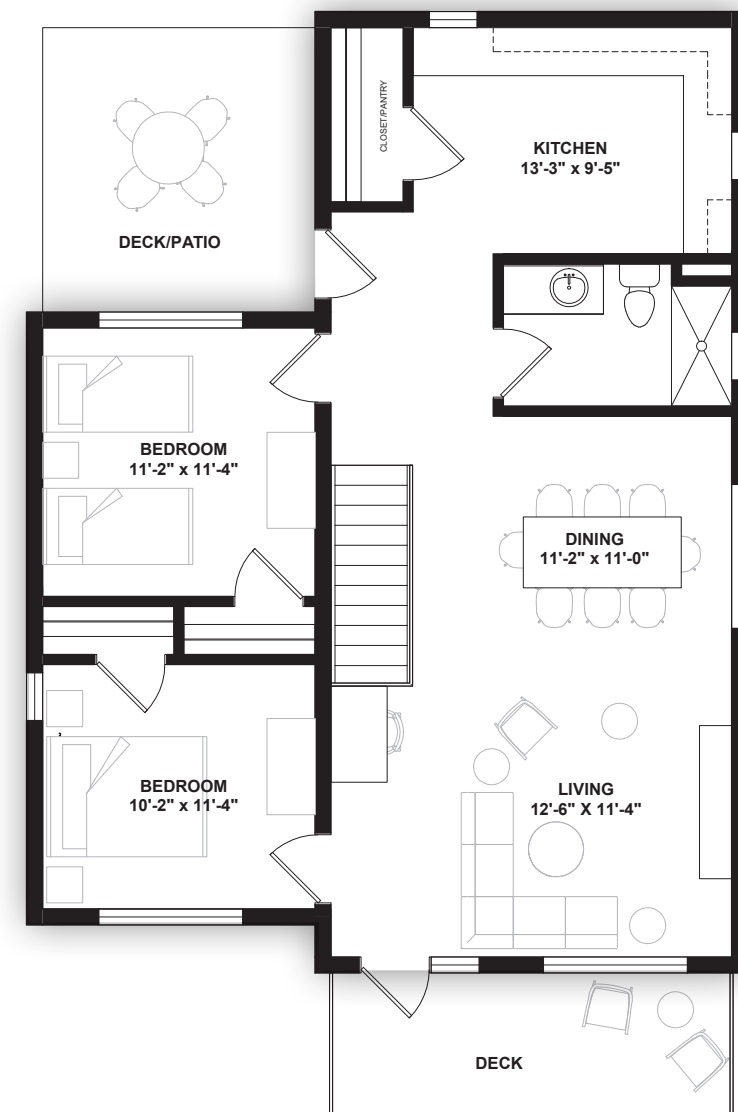
Garage 306 sf

Notes:
Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.



First Level

scale: 1/8" = 1'-0"

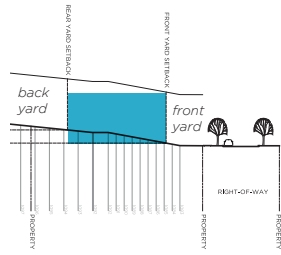


Second Level

scale: 1/8" = 1'-0"

Design Concept *continued*

The Blondo Alternate 2 - Partially Enclosed Kitchen w/ Extended Family Suite



“Walk-In Basement”

3 Bed/2 Bath Home, Including Extended Family Suite, w/ Office on Narrow Lot (40')

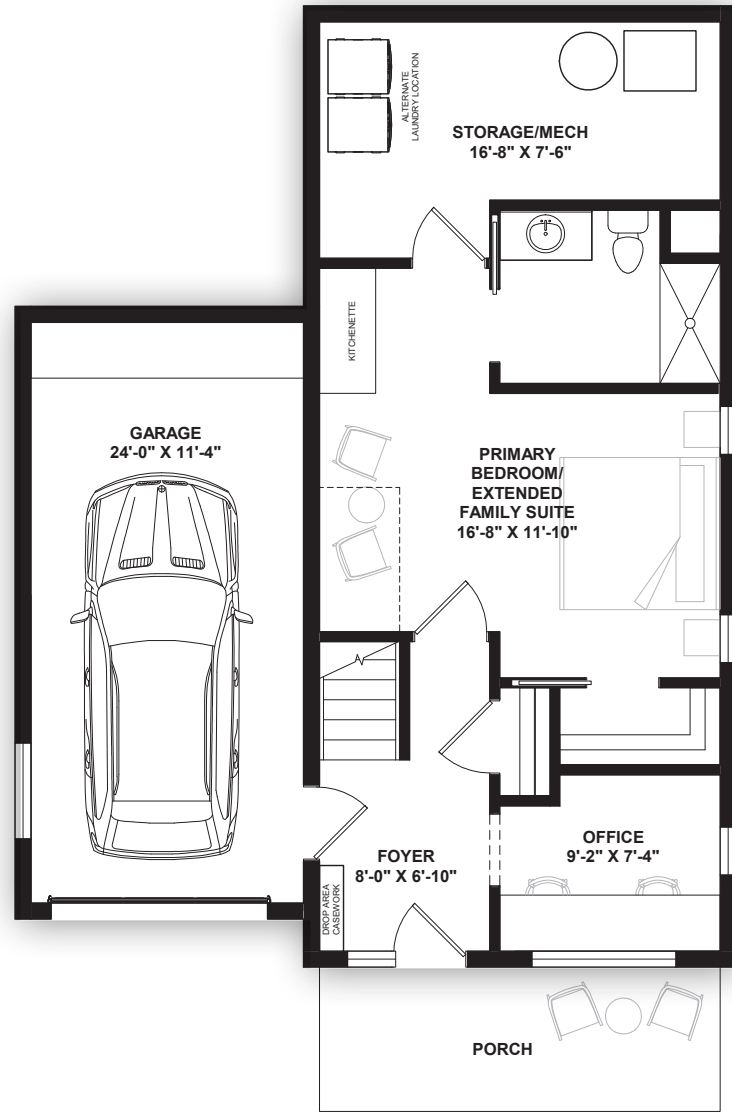
This plan is for homes that are built-into a hill because of site topography.

Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

Garage 306 sf

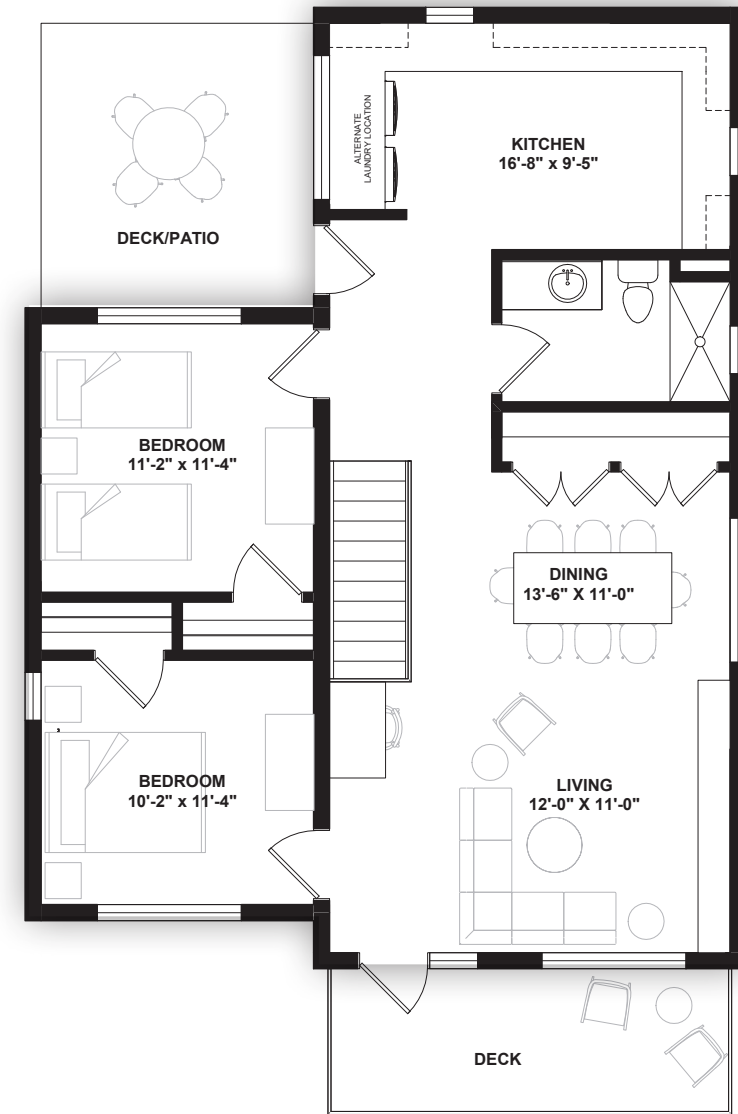
Notes:

Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.



First Level

scale: 1/8" = 1'-0"

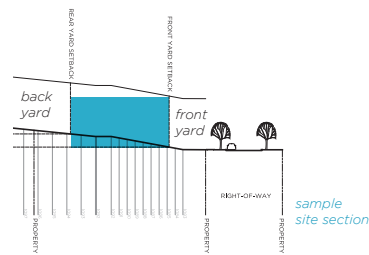


Second Level

scale: 1/8" = 1'-0"

Design Concept *continued*

The Blondo Alternate 3 - Partially Enclosed Kitchen w/ Live/Work Option



“Walk-In Basement”

3 Bed/2 Bath Home, Including Extended Family Suite, w/ Office on Narrow Lot (40')

This plan is for homes that are built-into a hill because of site topography.

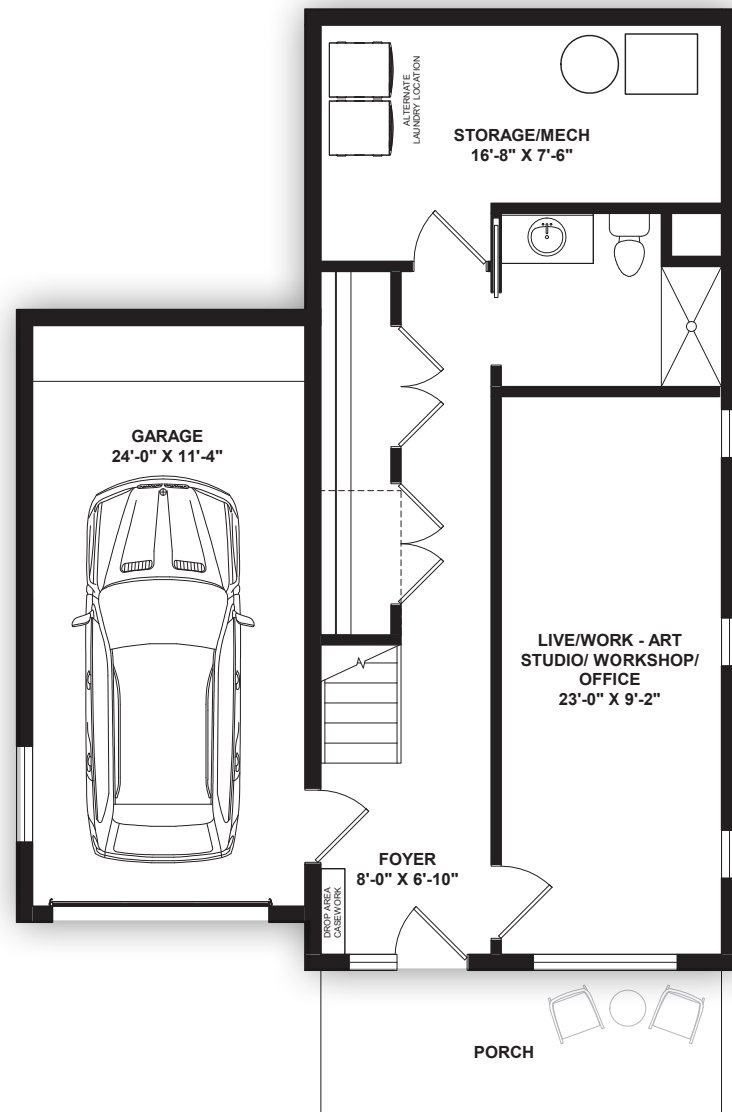
Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

Garage 306 sf

Notes:

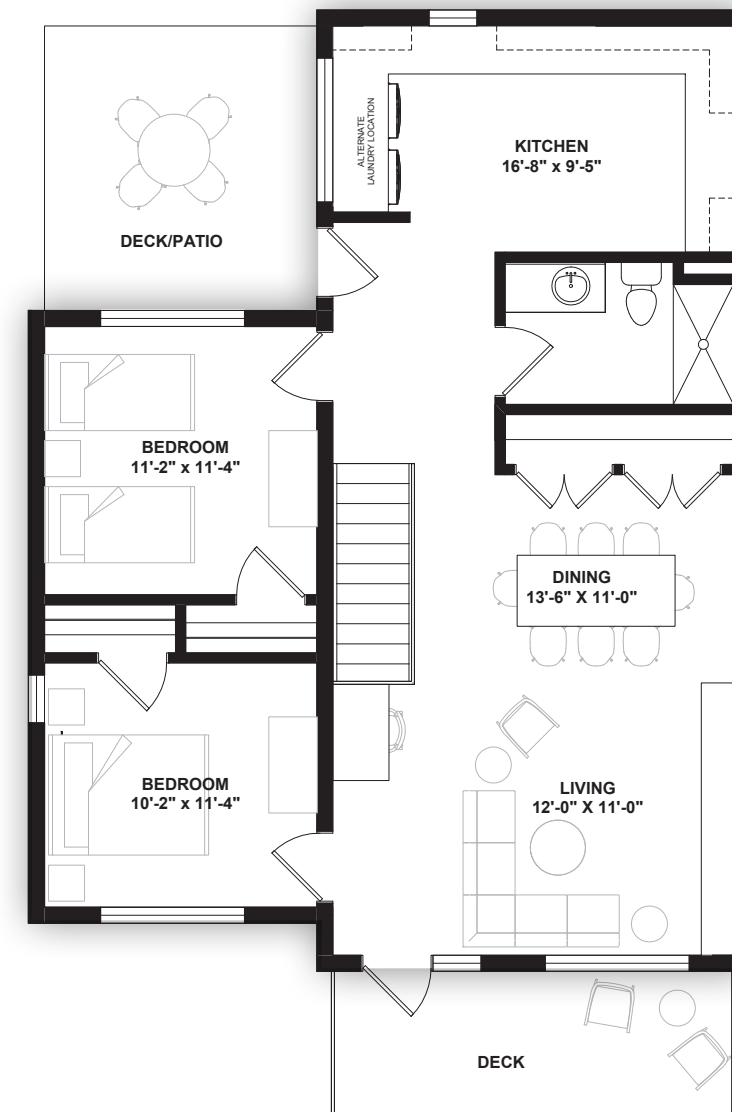
Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.

By shifting the bathrooms north, this plan could also accommodate the open kitchen shown in the base Blondo plan on page 44.



First Level

scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"

Materials + Components

Everyone should feel a sense of pride in their home; it should reflect the owner's personal style and preferences. The various truss configurations noted on earlier pages go a long way in creating variety, and can be complemented by material selections and additional design components.

For the exterior, this includes the form (roof style, overhang depths, porches), the cladding (material type and color palette), and the openings (windows and doors), along with a range of other elements, including landscaping. On this page and the next, we've provided three example exterior palettes for the homes. These are in no way all-inclusive, but are instead intended to show the variety in design styles that can be created by modifying this relatively small list of design components. Each of the palettes is shown applied to the same base plan.

Following the exterior palette summaries there are sample elevations of the three floor plan concepts using these three design options.

For the interior, we've also provided three example palettes on the following pages. These range in price points, with Palette A being the least expensive, and Palette C being the most costly. Similar to the exterior, these are not intended to be prescriptive, but are instead meant to provide a frame of reference so individual homeowners can make finish selections based upon their own needs and preferences. A matrix that includes all three interior palettes for easy comparison is located in the appendix of this document.

Sample case work elevations for the various interior components - such as a galley kitchen vs. an L-shaped kitchen - are provided at the end of this section.



Transitional *Sample Exterior Material Palette*

Form

- 12"-18" deep overhangs
- Single-slope roof form
- Single-slope, covered, cast in place porch with integrated 1:20 ramp and 4" perimeter curb for enhanced accessibility

Cladding

- White 4" exposure smooth-textured lap siding with mitered corners
- Charcoal gray 3" wide trim
- Charcoal gray fascia panels
- 4" plank western red cedar soffits with ventilation inserts as needed
- Black asphalt shingles

Openings

- Vinyl or fiberglass windows with black exterior cladding
- Wood stained and sealed front door
- Black or dark bronze door hardware
- White raised-panel garage door



Traditional *Sample Exterior Material Palette*

Form

- 12"-18" deep overhangs
- Gabled roof form
- Gabled roof, covered, cast in place two-step front stoop

Cladding

- Blue 12" board and batten siding
- Light gray 4" exposure smooth-textured lap siding with trimmed corners
- White trim, fascia, and ventilated soffit panels
- Grey asphalt shingles

Openings

- Vinyl or fiberglass windows with white exterior cladding
- White raised-panel garage doors
- Painted decorative front door
- Worn bronze door hardware



Modern *Sample Exterior Material Palette*

Form

- No overhangs
- Single-slope roof form
- Uncovered, cast in place, two-step front porch with integrated planter

Cladding

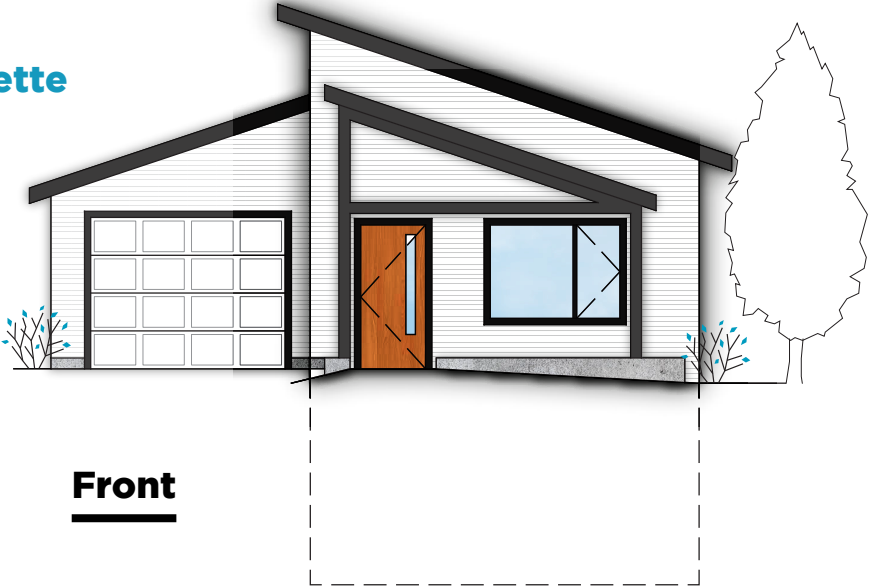
- Charcoal 4" smooth-textured lap siding with mitered corners
- Charcoal 12" board and batten siding
- Charcoal gray trim and fascia panels
- Black asphalt shingles

Openings

- Vinyl or fiberglass windows with black exterior cladding
- Brightly painted front door
- Black or dark bronze door hardware
- Charcoal gray raised-panel garage door

Design Concept *continued*

Sample Elevations The Burdette w/ Transitional Palette



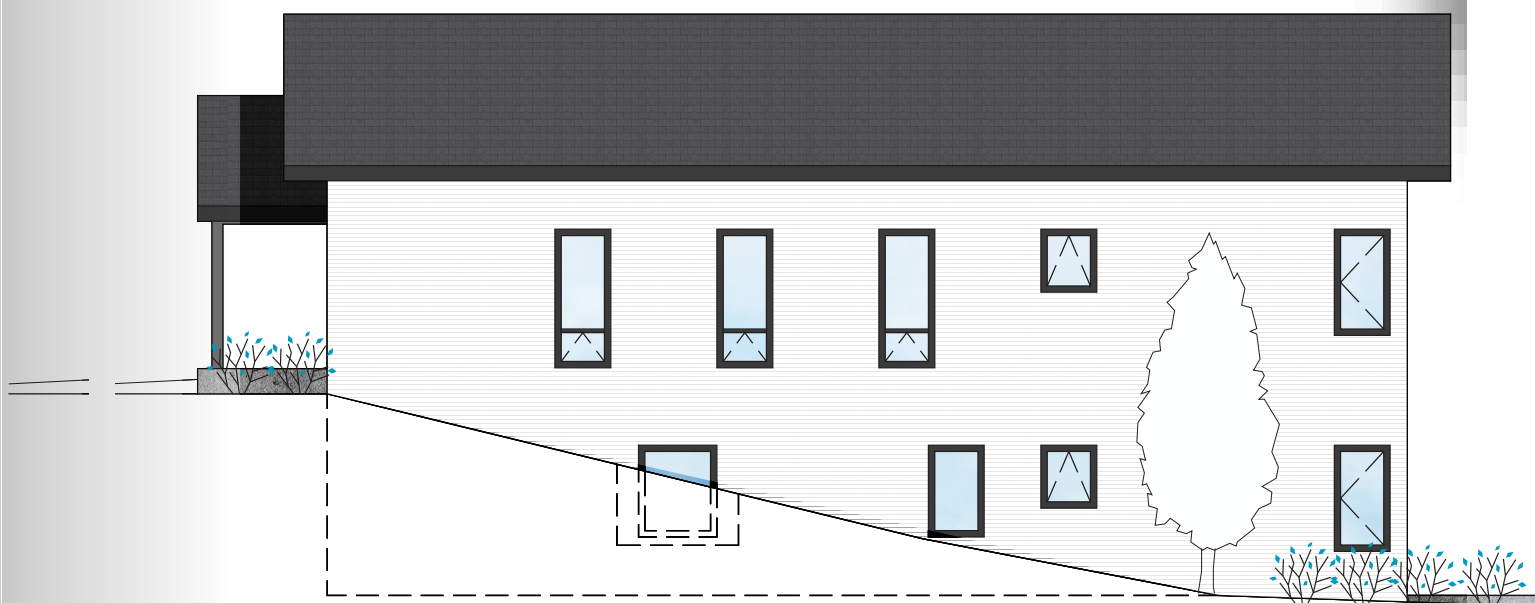
Front



Side



Back



Side

Design Concept *continued*

Transitional Palette

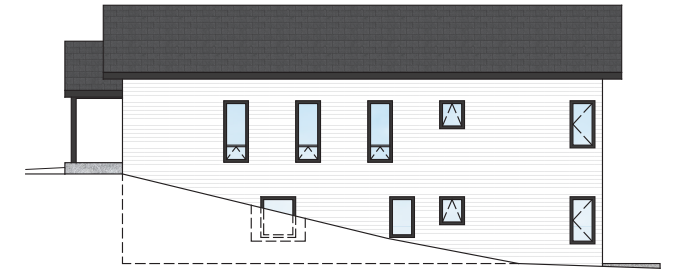
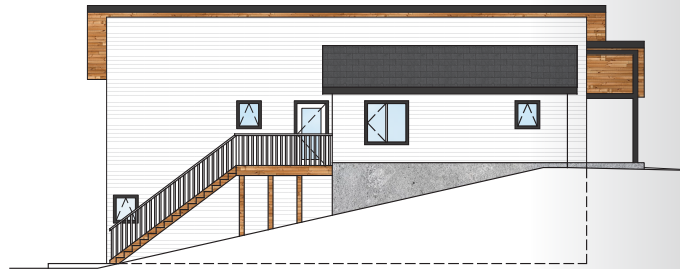
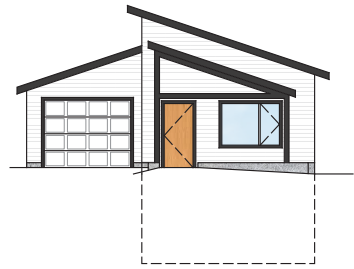
Front

Side

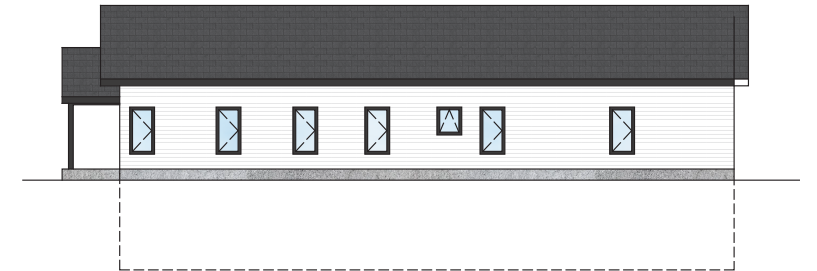
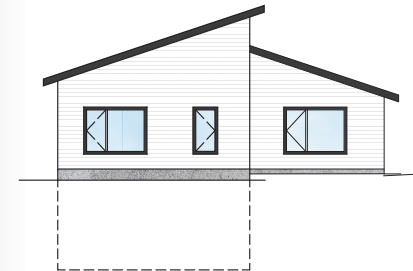
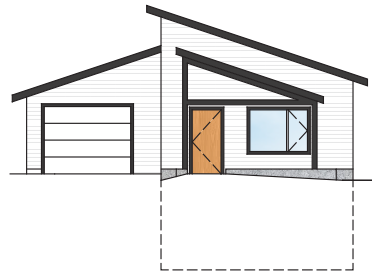
Back

Side

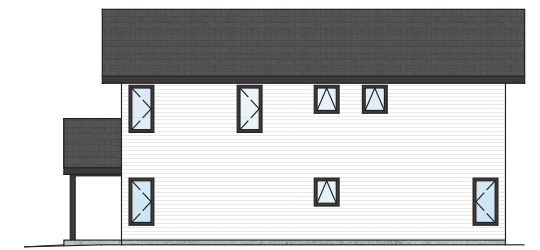
The Parker



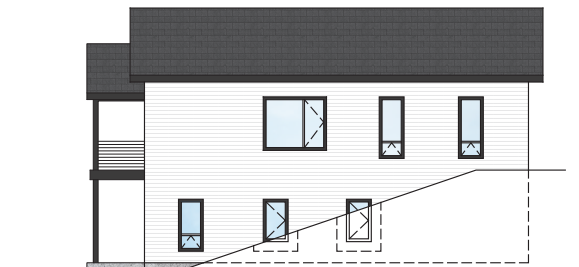
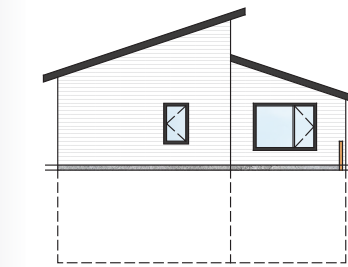
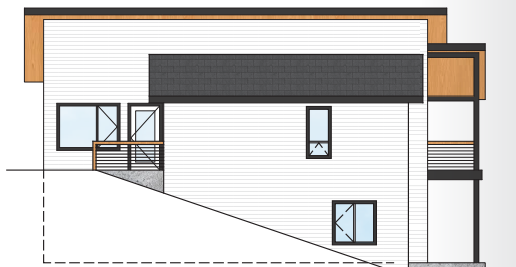
The Burdette



The Patrick

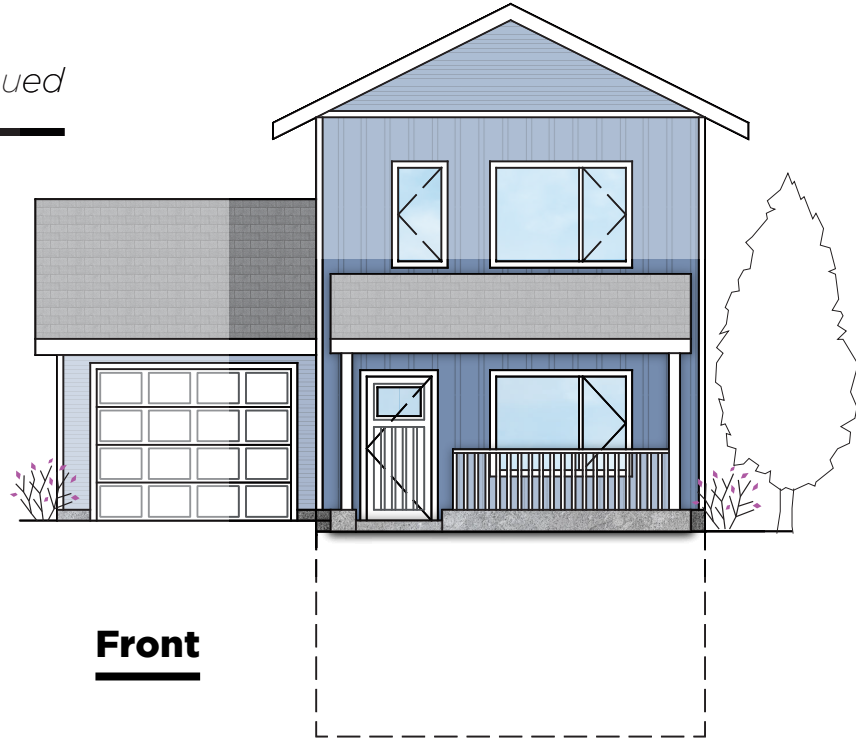


The Patrick

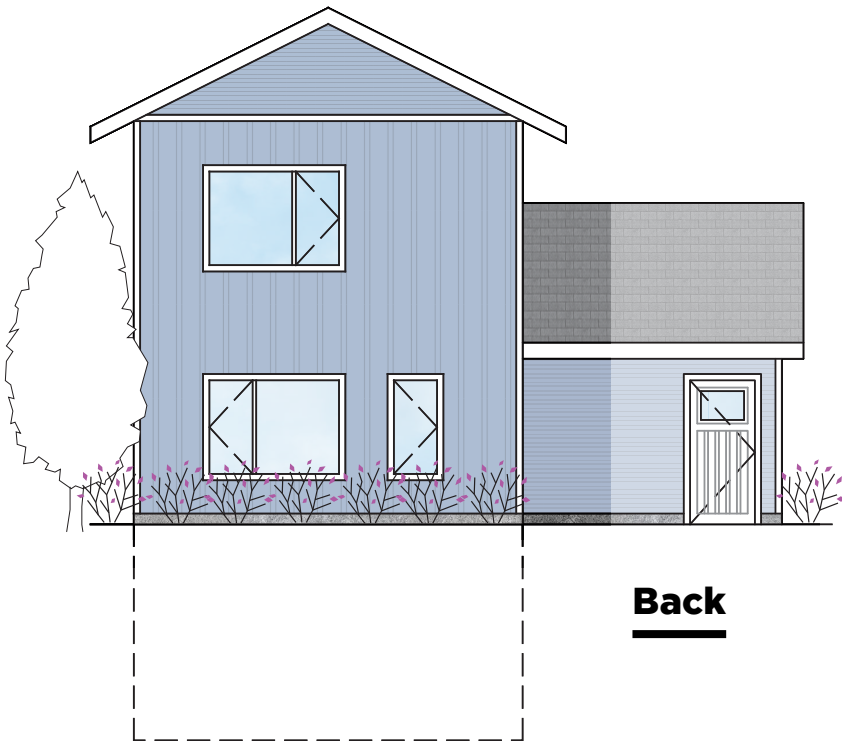


Design Concept *continued*

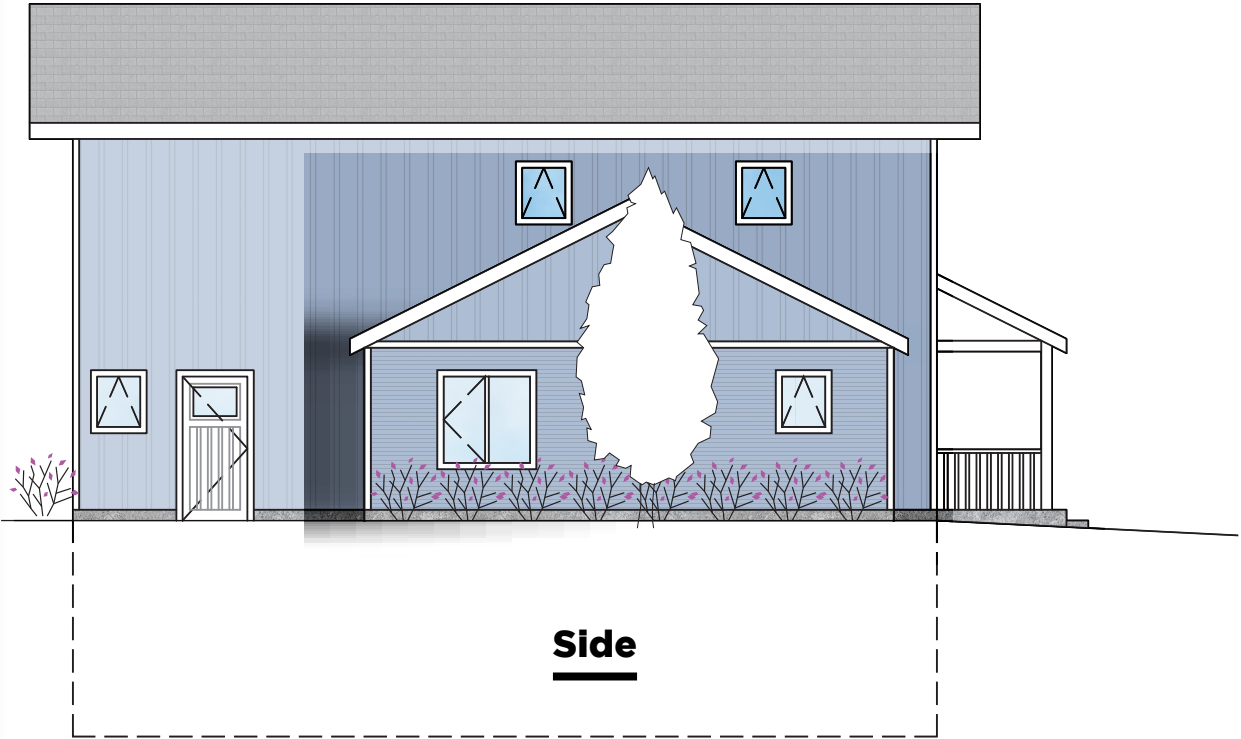
Sample Elevations The Patrick w/ Traditional Palette



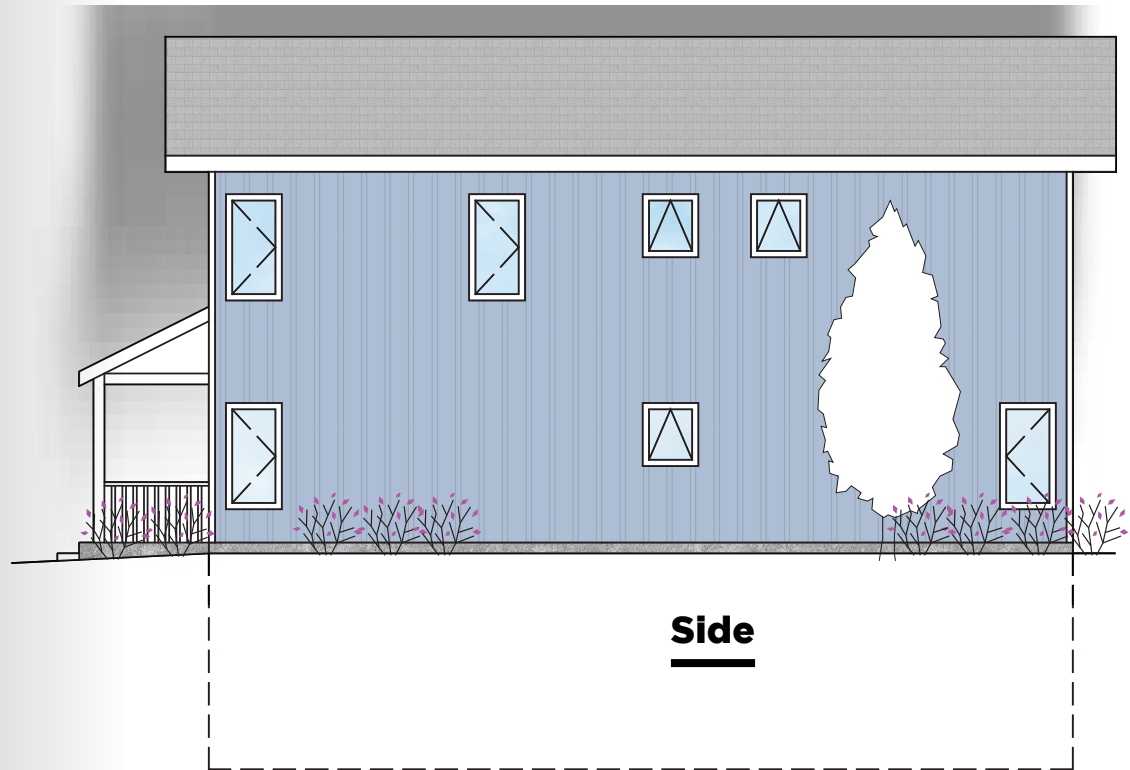
Front



Back



Side



Side

Design Concept *continued*

Traditional Palette

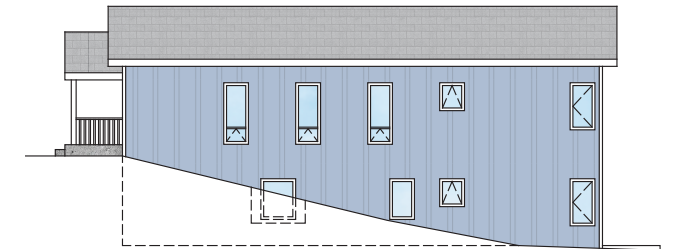
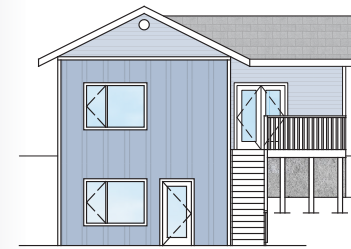
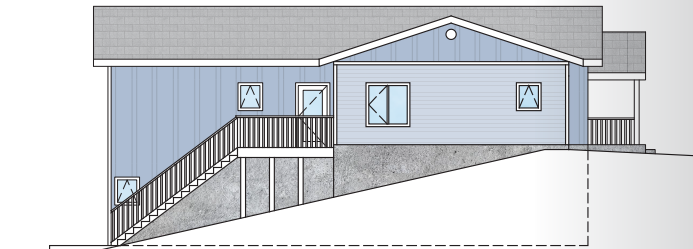
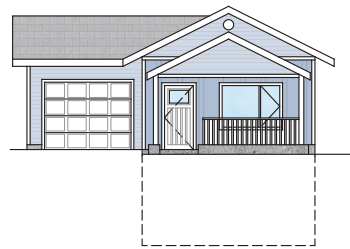
Front

Side

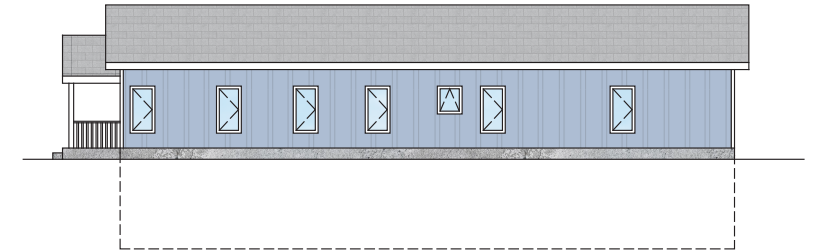
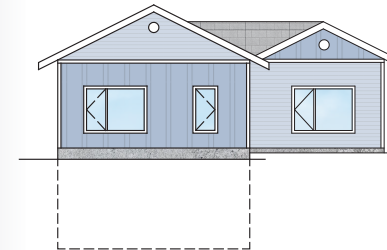
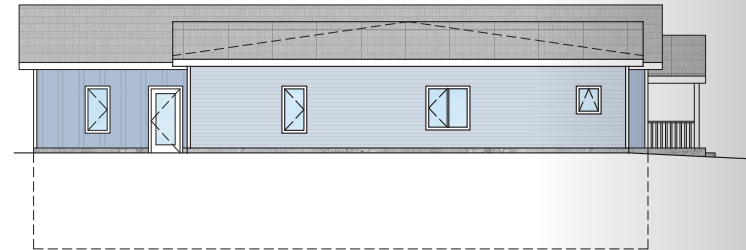
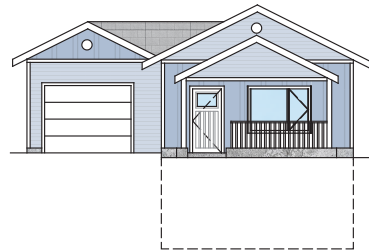
Back

Side

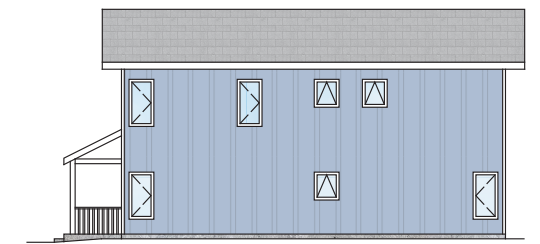
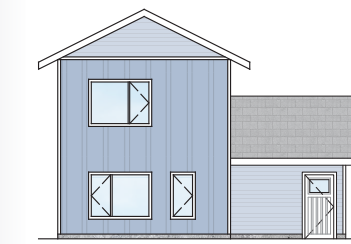
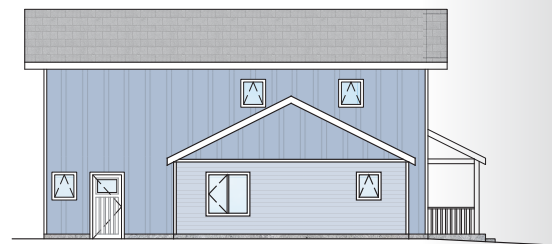
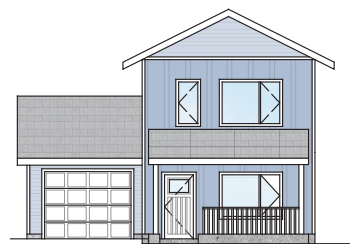
The Parker



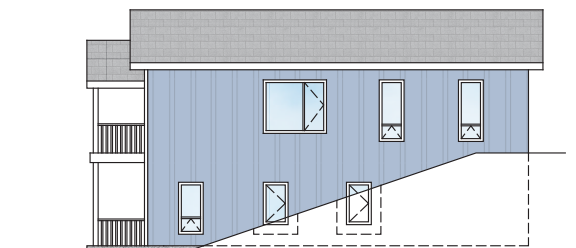
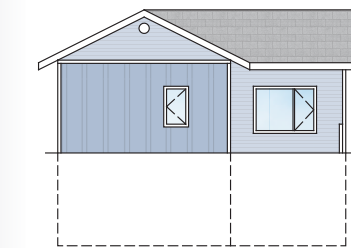
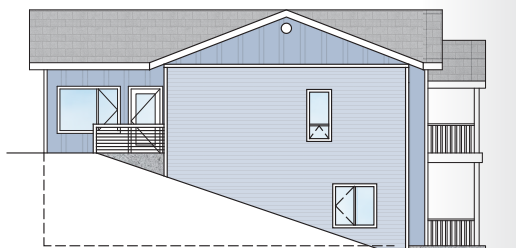
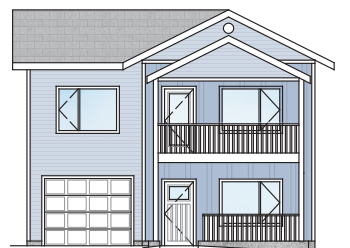
The Burdette



The Patrick



The Patrick



Design Concept *continued*

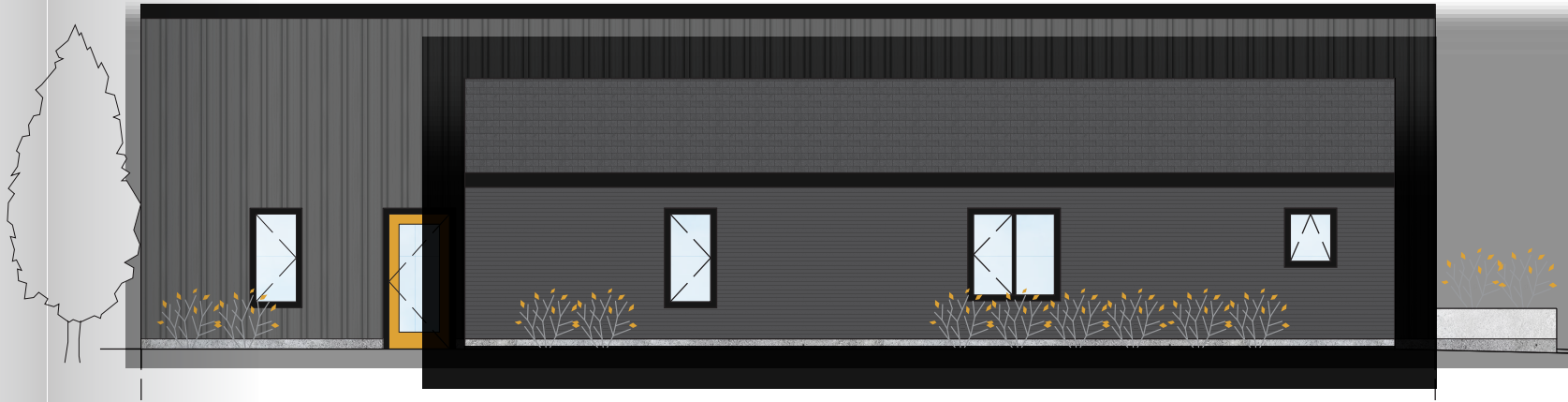
Sample Elevations The Parker w/ Modern Palette



Front



Back



Side



Side

Design Concept *continued*

Modern Palette

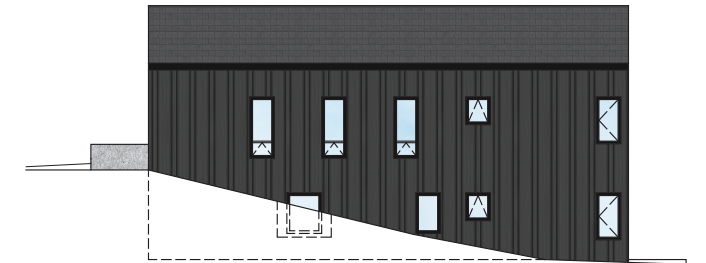
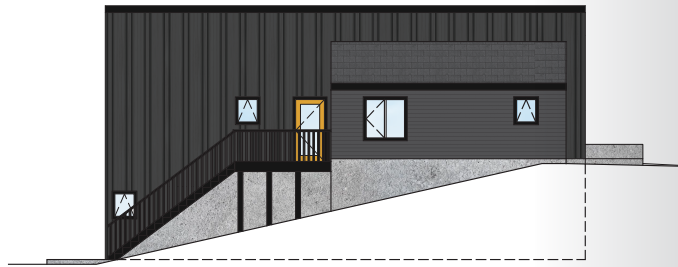
Front

Side

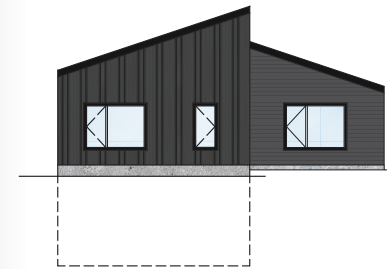
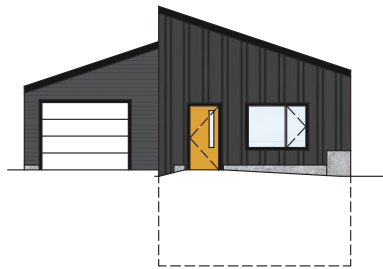
Back

Side

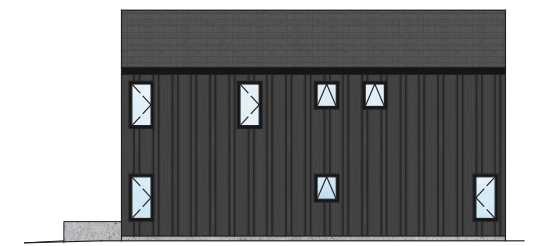
The Parker



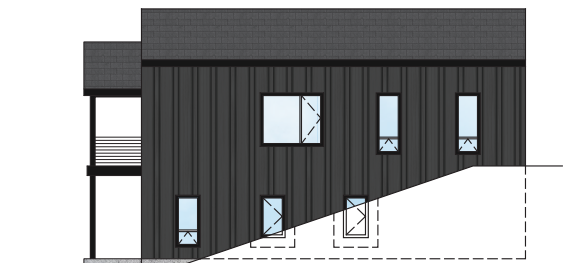
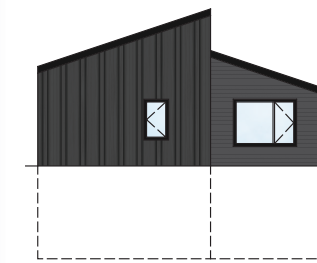
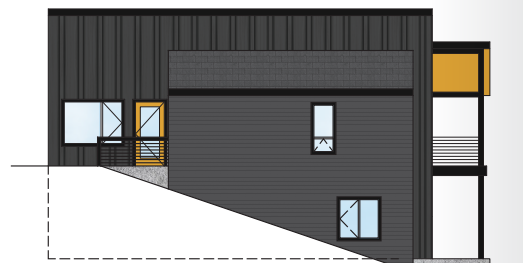
The Burdette



The Patrick



The Patrick



Interior Materials

Material Palette A

General

- Flat panel exterior entry doors w/ peep hole
- Flat panel interior doors
- 1x4 MDF pre-finished base and trim @ doors and windows as needed
- 1 color wall paint throughout
- Thin surface-mount puck lighting @ circulation areas
- Switched outlets @ living room(s) [no overhead lights]
- Appliances (black or white):
 - Refrigerator
 - Range
 - Over the range microwave
 - Washer & dryer
- Window coverings: 1" aluminum blinds
- White wire shelving & rods @ closets
- Door & cabinet hardware:
 - Standard brushed/satin nickel finishes
 - Keyed & deadbolt entry locks

Flooring Finishes

- Luxury Vinyl Tile (LVT) flooring throughout (Living, kitchen, bathrooms, etc.)

Kitchen

- Single basin stainless steel sink, fixed dual or single handle chrome faucet
- Prefabricated plywood box cabinets, pre-finished
- Plastic laminate countertops w/ 4" back splash
- 12" deep upper cabinets, 24" deep base cabinets

Bathrooms

- Solid surface countertop w/ under-mount sink
- Prefabricated plywood box cabinets, pre-finished, 21" deep base cabinets
- Prefabricated tub and shower insert w/ curtain rod
- Standard toilet
- Toilet accessories:
 - 1 - 24" towel bar
 - 1 - towel ring @ sink
 - 1 - shower curtain rod
 - 1 - free standing toilet paper holder
 - 1 - plate glass mirror



**Interior materials and components based off December 2021 market climate and typical assumptions from similar projects*

**Finish palettes shown for visual reference of materials and components*

Interior Materials *continued*

Material Palette B

General

- Paneled exterior entry doors w/ sidelight
- 2 panel interior doors
- 1x4 painted hardwood base and trim @ doors and windows as needed (any color)
- 1 main color wall paint throughout
- Painted accent walls or rooms as determined by owner
- Thin surface-mount puck lighting, all lights switched and dimmable
- Appliances (stainless steel):
 - Refrigerator
 - Range
 - Over the range microwave
 - Washer & dryer
- Window coverings: 2" wood blinds (solid color or wood finish)
- Residential carpet in living and bedrooms
- Ceramic tile in bathrooms
- White wire shelving & rods @ closets
- Door & cabinet hardware:
 - Standard brushed/satin nickel finishes
 - Keyed & deadbolt entry locks

Flooring Finishes

- Luxury Vinyl Tile (LVT) flooring in kitchen
- Residential carpet in living and bedrooms

- Ceramic tile in bathrooms

Kitchen

- Double basin stainless steel sink, detachable goose neck faucet, brushed/satin nickel
- Prefabricated, upgraded box cabinets, painted white or wood stained finish
- Solid surface countertops w/ 4" back splash or ceramic tile
- 12" deep upper cabinets, 24" deep base cabinets

Bathrooms

- Solid surface countertop w/ under-mount sink
- Prefabricated upgraded box cabinets, painted white or wood stained finish, 21" deep base cabinets
- Prefabricated tub and shower insert w/ stainless and glass door system
- Standard toilet
- Toilet accessories:
 - 1 - 24" towel bar
 - 1 - towel ring @ sink
 - 1 - shower Curtain Rod
 - 1 - cabinet mounted toilet paper holder
 - 1 - plate glass mirror

**Interior materials and components based on December 2021 market climate and typical assumptions from similar projects*



**Finish palettes shown for visual reference of materials and components*

Interior Materials *continued*

Material Palette C

General

- Paneled door w/ glazing & sidelight
- 4 panel or other decorative door style, solid or hollow core
- 6" H painted or stained hardwood base
- Painted walls w/ accents or wallcovering accents as determined by owner
- Thin surface-mount puck lighting, dimmable & ceiling fans @ living spaces and bedrooms, all lights switched and dimmable
- Decorative pendant lights or specific light over sink & under cabinet lighting
- Appliances (Stainless Steel):
 - Refrigerator
 - Range
 - Over the range microwave
 - Washer & dryer
- Window coverings: Roller shades w/ curtains
- Solid plastic laminate shelving & wood rods @ closets
- Door & cabinet hardware:
 - Standard brushed/satin nickel finishes
 - Keyless entry system

Flooring Finishes

- Wood or upgraded residential carpet in living, common spaces & bedrooms
- Ceramic tile flooring at bathrooms
- Ceramic tile or wood flooring in kitchen

Kitchen

- Double basin stainless steel sink w/ disposal, detachable goose neck faucet, brushed/satin nickel
- Custom wood cabinets, stained or painted finish
- Quartz or granite countertops w/ 4" back splash or ceramic tile
- 12" deep upper cabinets, 24" deep base cabinets

Bathrooms

- Quartz or granite countertop w/ ceramic tile back splash
- Freestanding decorative vanity
- Tile shower walls, prefabricated tub, stainless & glass door system
- Dual flush toilets
- Toilet accessories:
 - 2 - 24" towel bars if wall space
 - 1 - Towel ring @ sink
 - 1 - decorative wall/cabinet mounted toilet paper holder
 - 1 - decorative mirror

**Interior materials and components based off December 2021 market climate and typical assumptions from similar projects*



**Finish palettes shown for visual reference of materials and components*

Interior Components

General

- 36" clear path through common areas, minimum 1 bedroom and 1 bathroom w/ shower or tub
- 42" wide hallways
- Door clearances on push/pull side @ all unit doors along accessible path
- 36" wide doors (34" min clear when door in 90° position)
- Outlets at 18" - 24" AFF
- Rocker style switches preferred
- Lever style door handles
- Light switches 42" AFF
- 60" turn radius near bed
- Front loading washer & dryer

Kitchen

- Base cabinets, counters, and sink rim to be no higher than 34" AFF
- 40" between any appliance, counter or other fixed objects (60" at U-Shaped configuration)
- Roll under sink or adaptable cabinet for roll under condition, 30" wide clear
- Accessible workstation adjacent to stove, 30" wide clear below
- Undersink controls for garbage disposal
- 50% of shelving between 18" - 48" (lowered upper cabinets as necessary)
- 6" max sink depth
- ADA compliant appliances

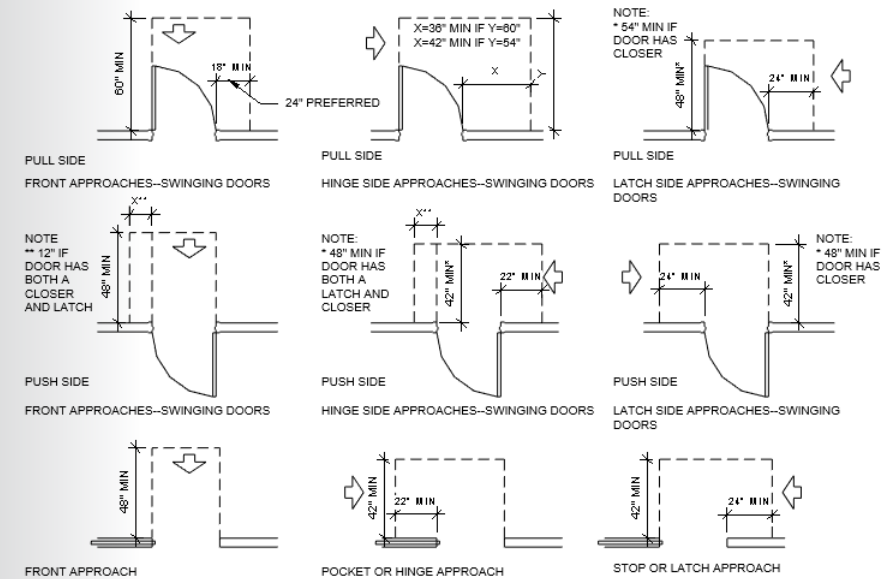
Accessibility Considerations

- Dishwasher to fit under 34" counter
- Drop-in or slide in accessible range
- Accessible refrigerator
- Countertop or under counter microwave
- Single hood over range
- Controls for hood within cabinet adjacent to range or at accessible location

Bathrooms

- Required clearances at toilet, sink, and shower/tub
- Cabinets, counters and sink rim to be no higher than 34" AFF
- 30" min clear width under sink w/ accessible heights, centered on sink
- Grab bars at toilet & shower/tub at accessible height
- Fold-up shower seat or provide minimum required backing for future installation
- Lever style faucet controls
- Height-adjustable hand wand at shower
- No pedestal sinks
- Optional curbless shower in main bathroom or 1 other main bathroom: 48"x48" or 30"x60" (with a 34" - 36" opening open access on the longer side)

**Interior materials and components based off December 2021 market climate and typical assumptions from similar projects*



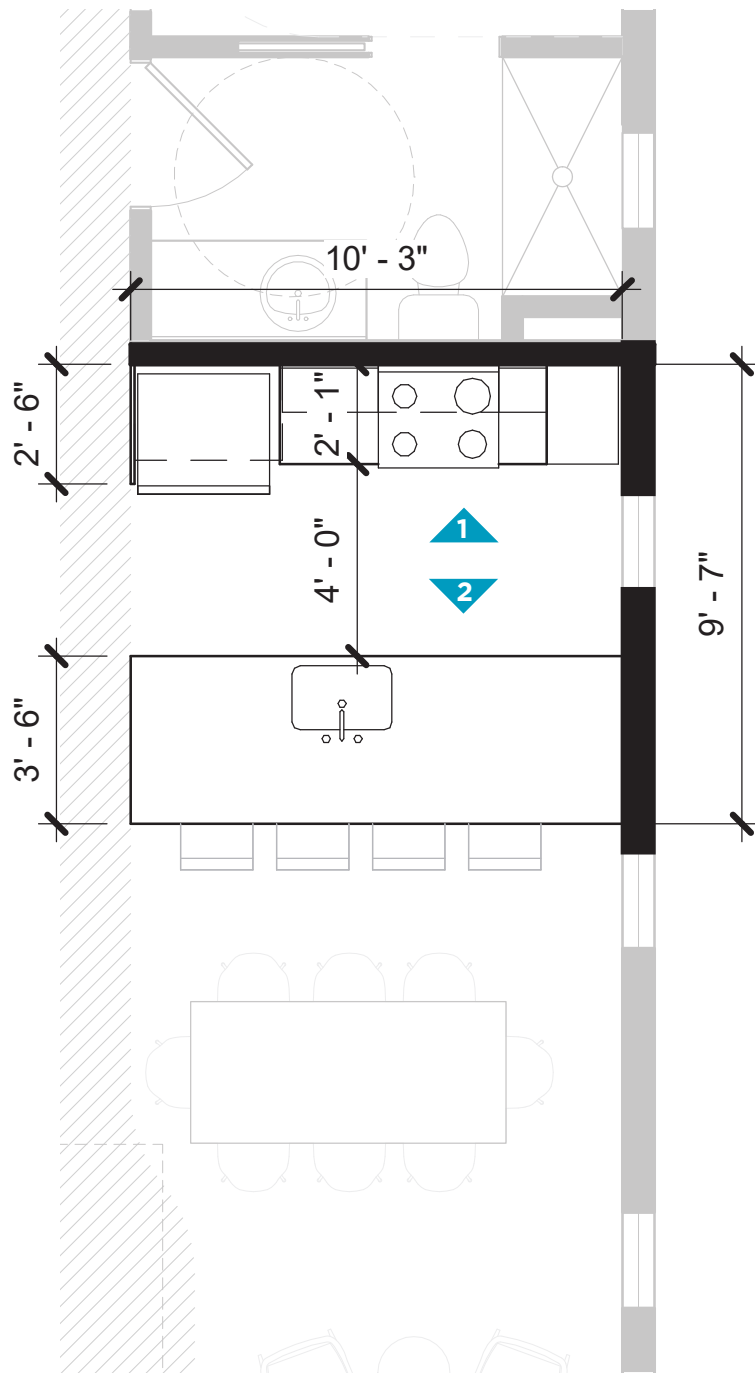
Door clearances



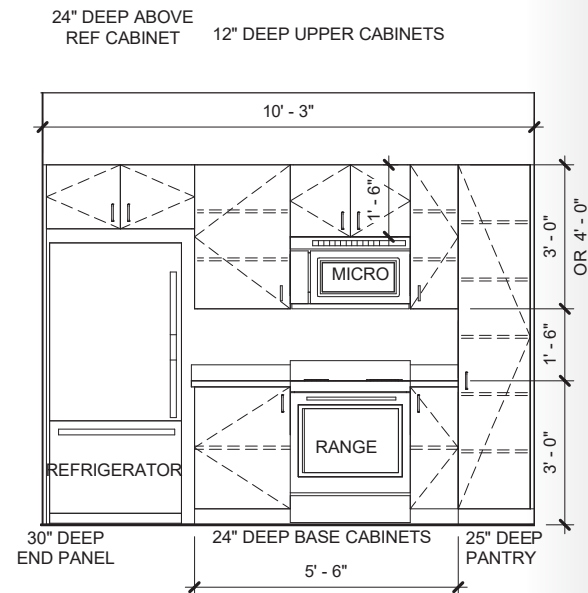
Bathroom components

Interior Components *continued*

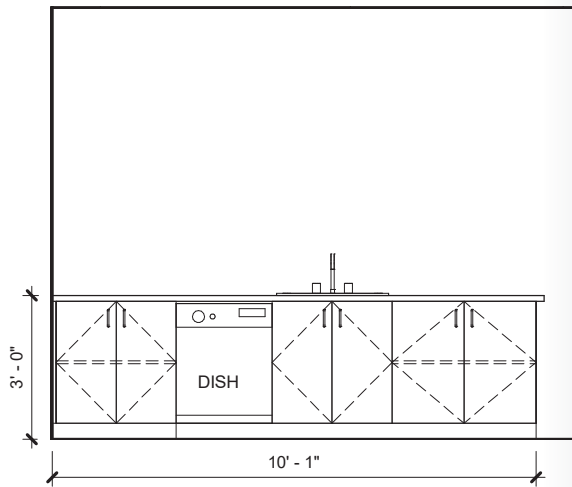
Kitchen Layout Two-Sided Galley



FLOOR PLAN
(1/4" = 1'-0")

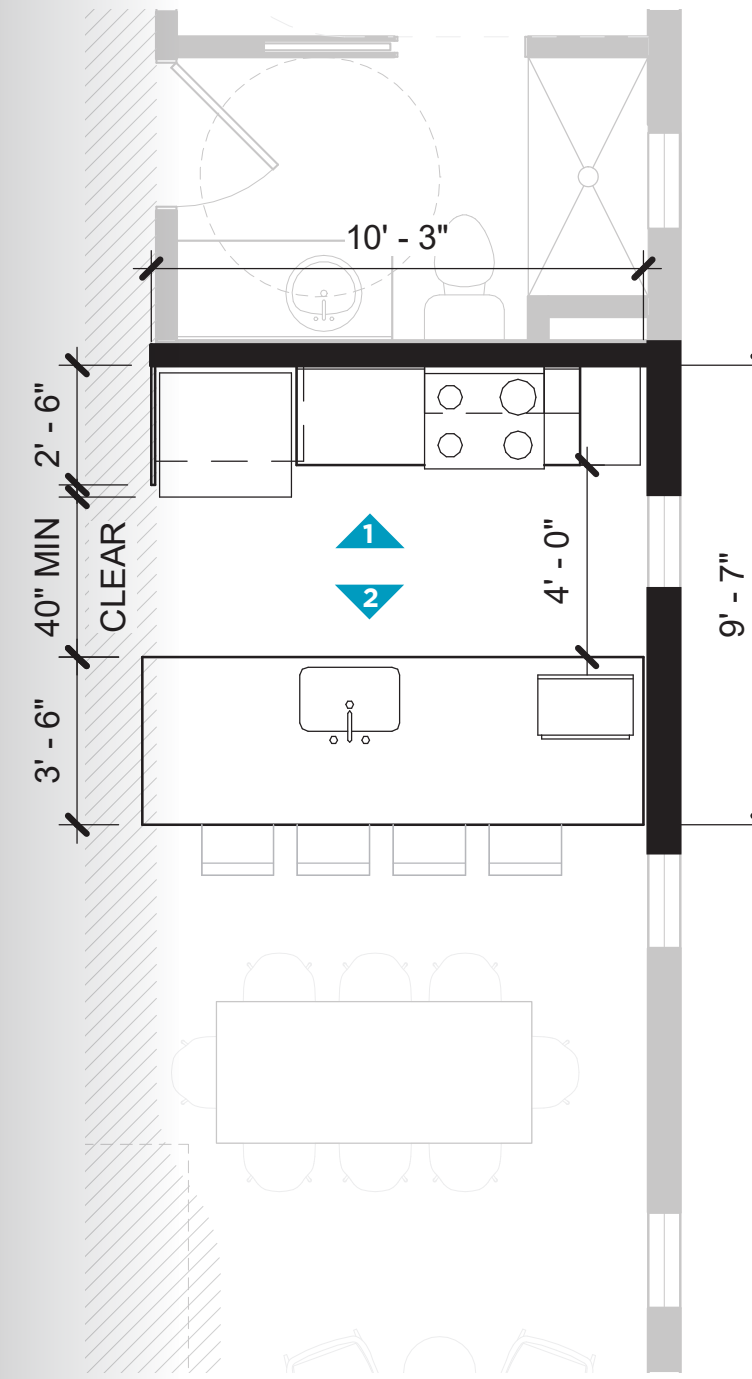


ELEVATION 1

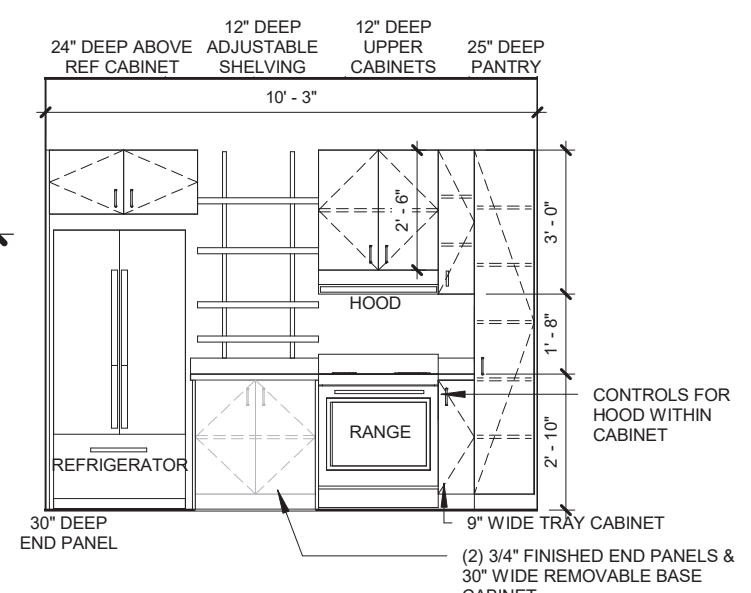


ELEVATION 2

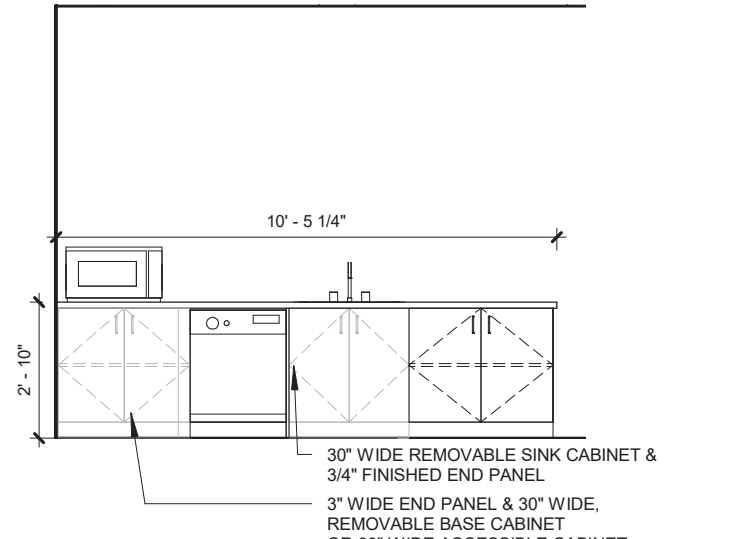
Kitchen Layout Two-Sided Galley, Modified



FLOOR PLAN
(1/4" = 1'-0")



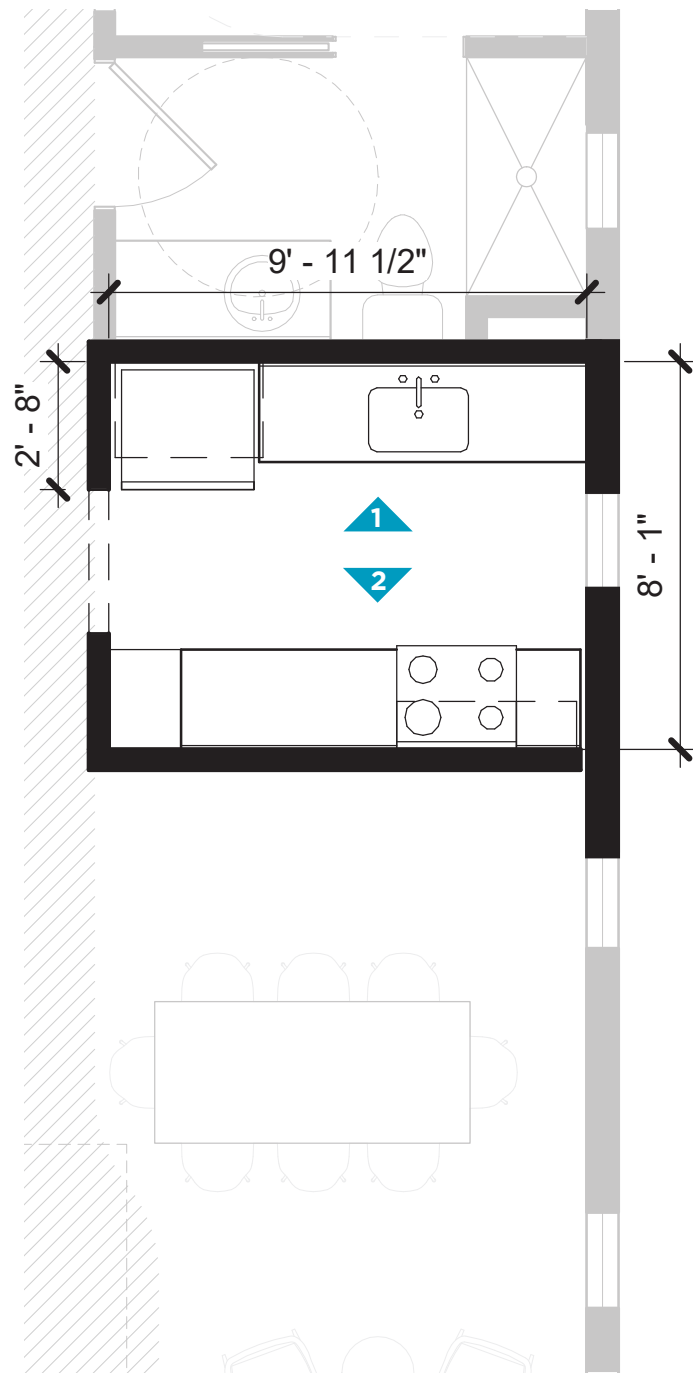
ELEVATION 1



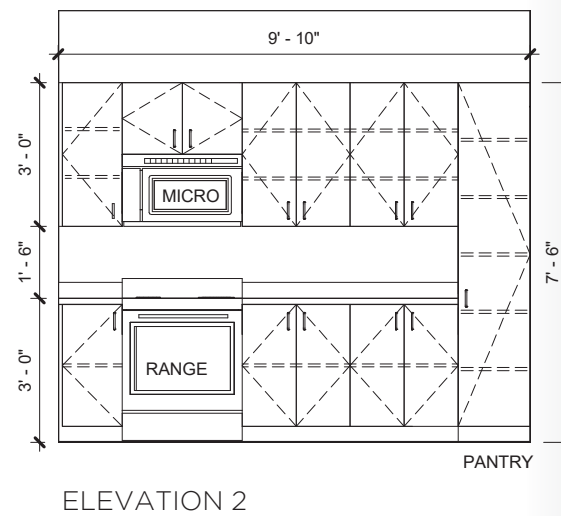
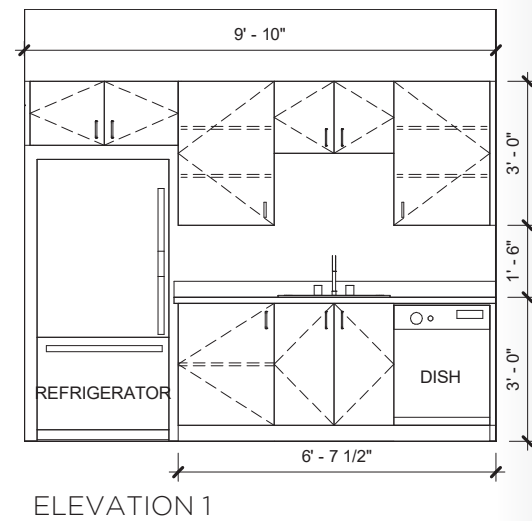
ELEVATION 2

Interior Components *continued*

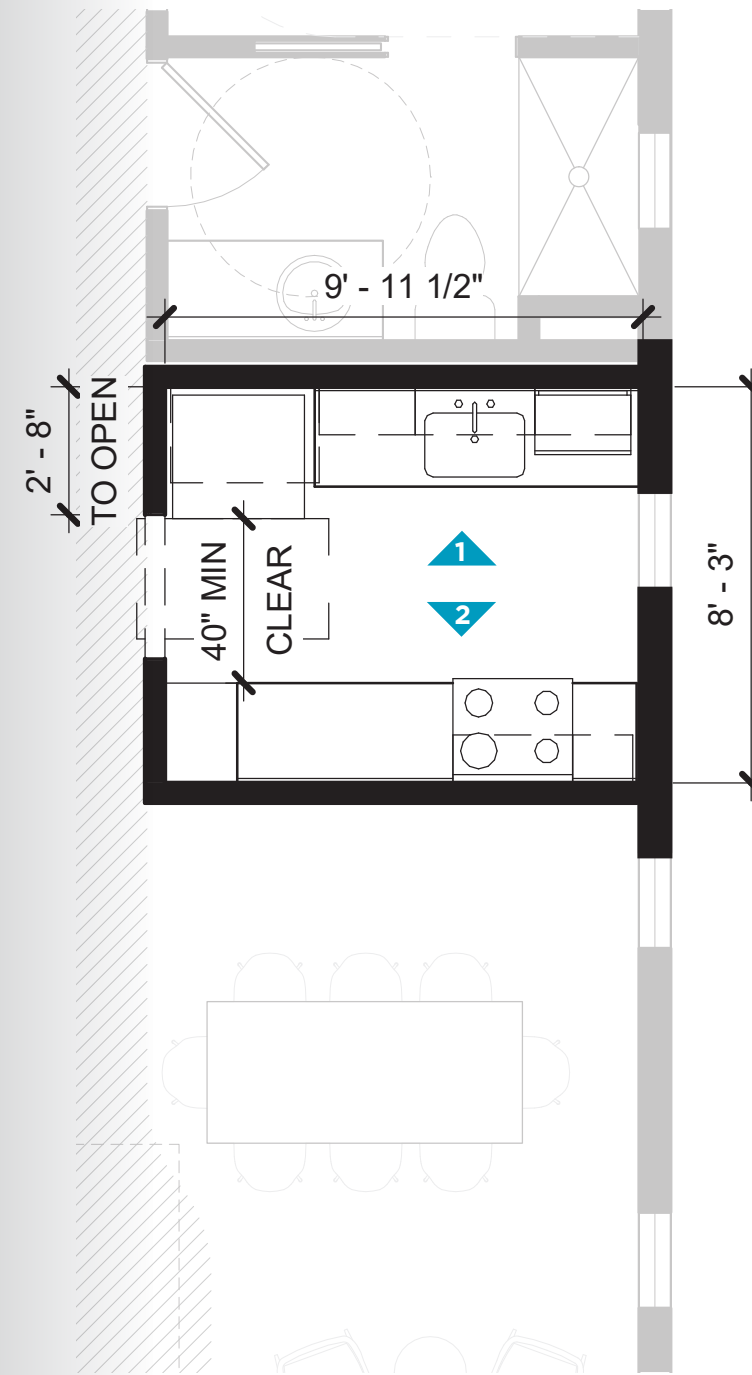
Kitchen Layout Enclosed Galley



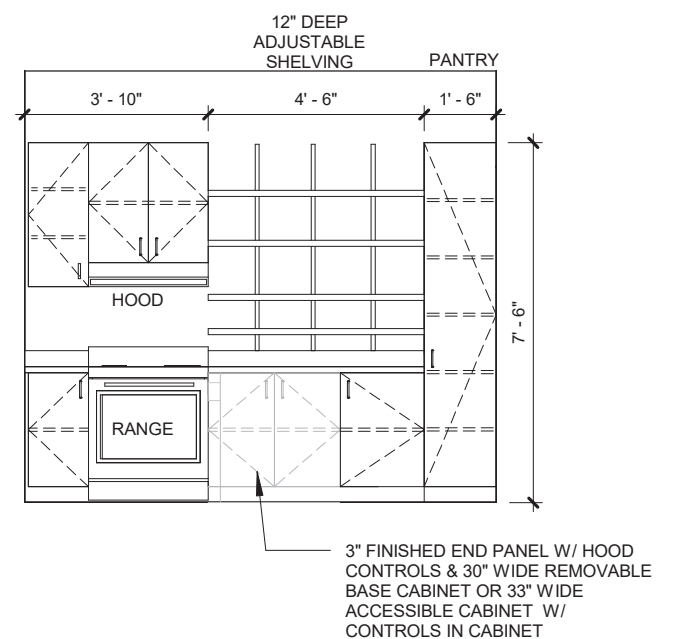
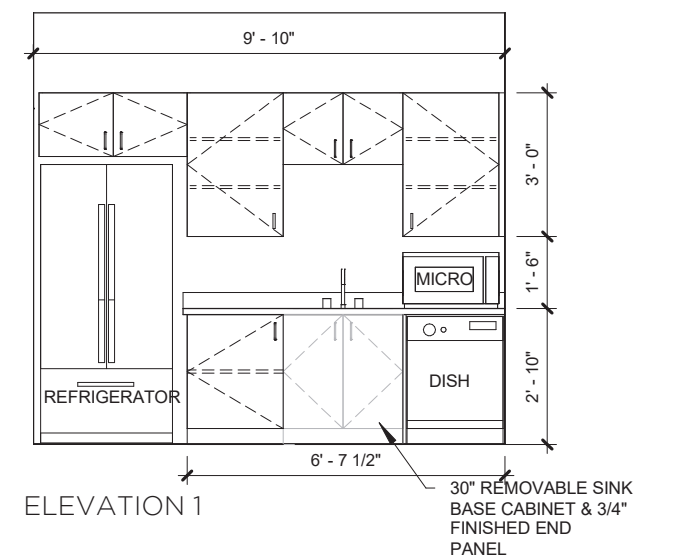
FLOOR PLAN
(1/4" = 1'-0")



Kitchen Layout Enclosed Galley, Modified

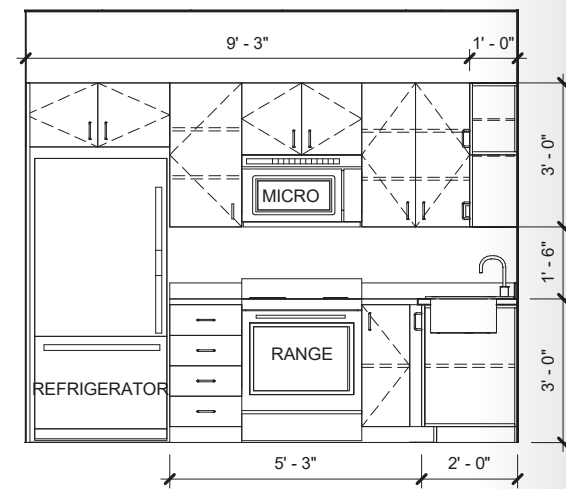
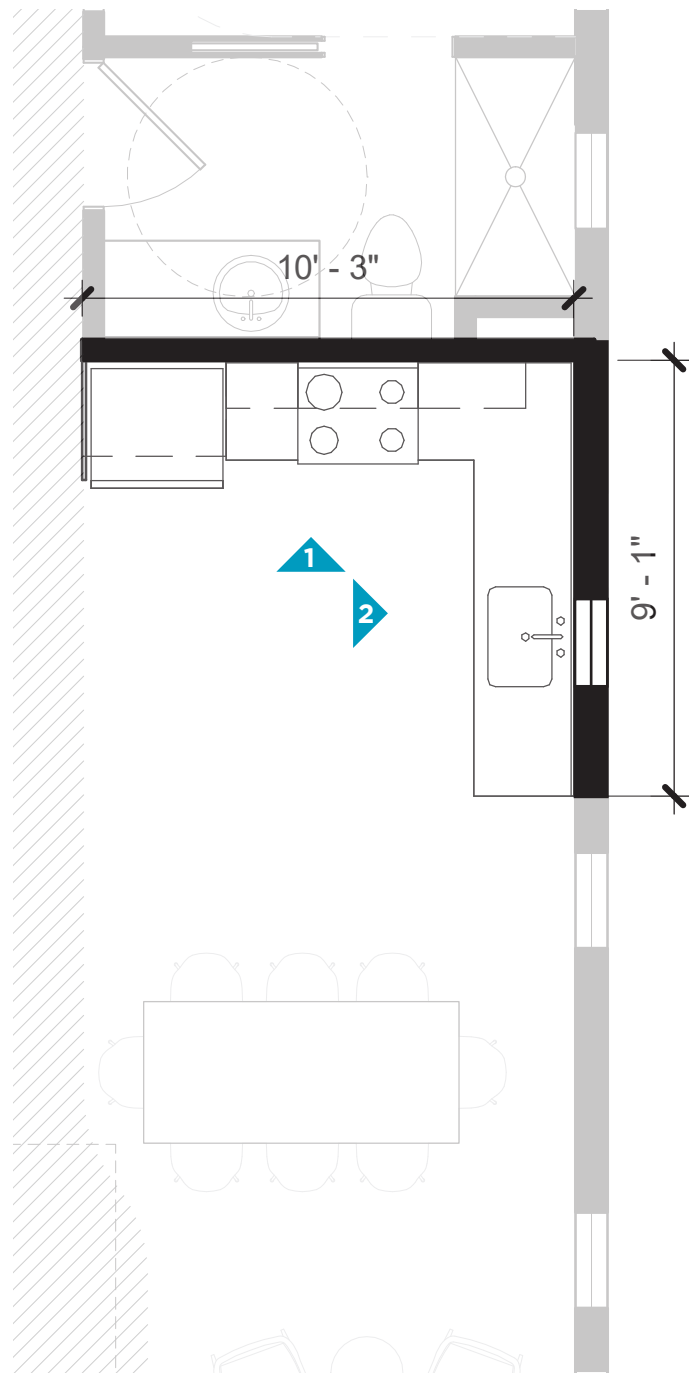


FLOOR PLAN
(1/4" = 1'-0")

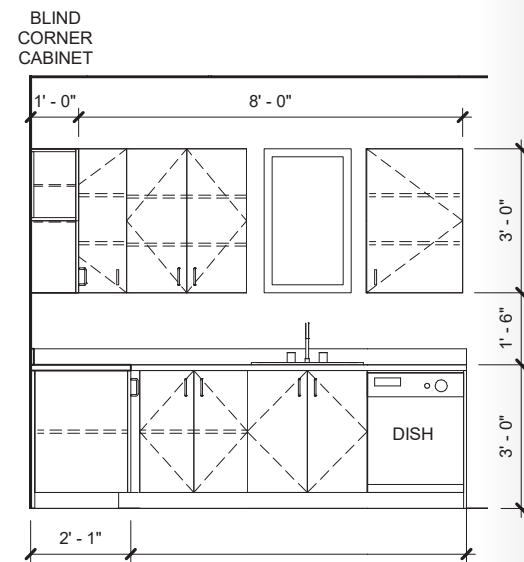


Interior Components *continued*

Kitchen Layout L-Shaped



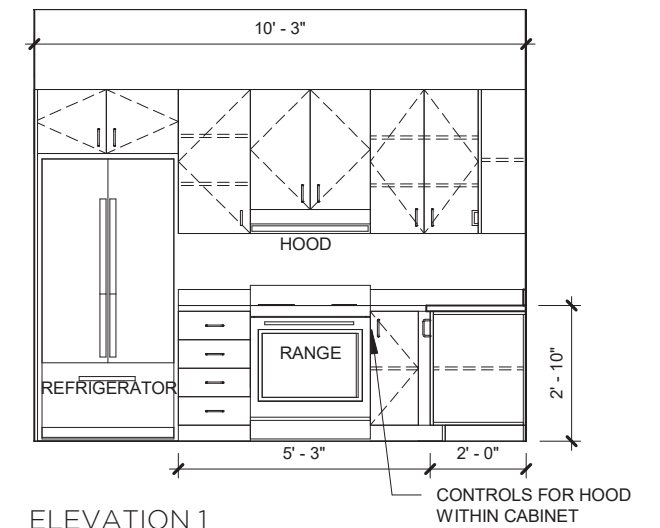
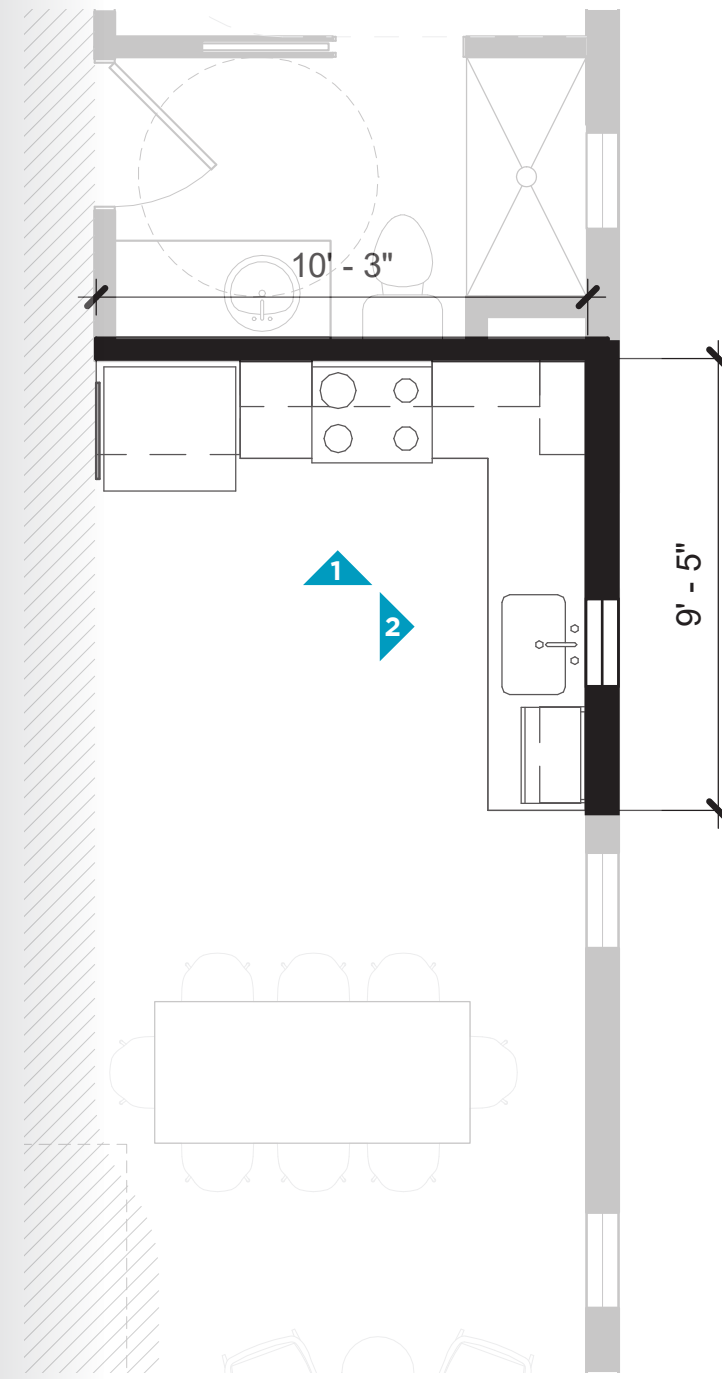
ELEVATION 1



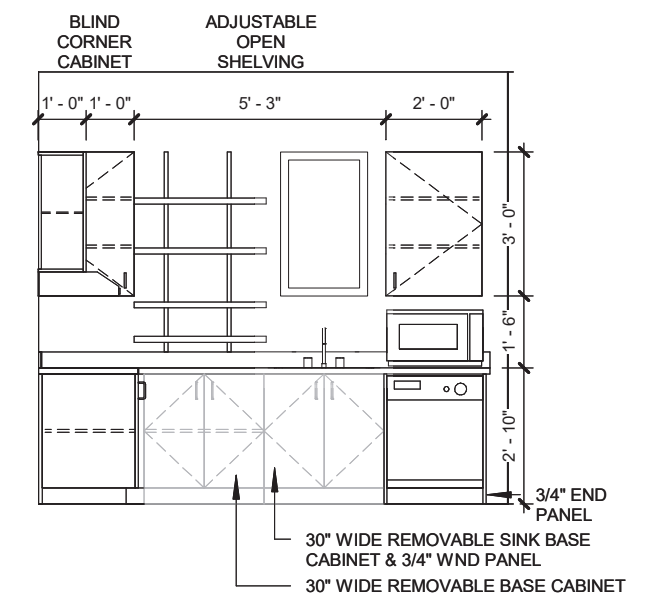
ELEVATION 2

FLOOR PLAN
(1/4" = 1'-0")

Kitchen Layout L-Shaped, Modified



ELEVATION 1

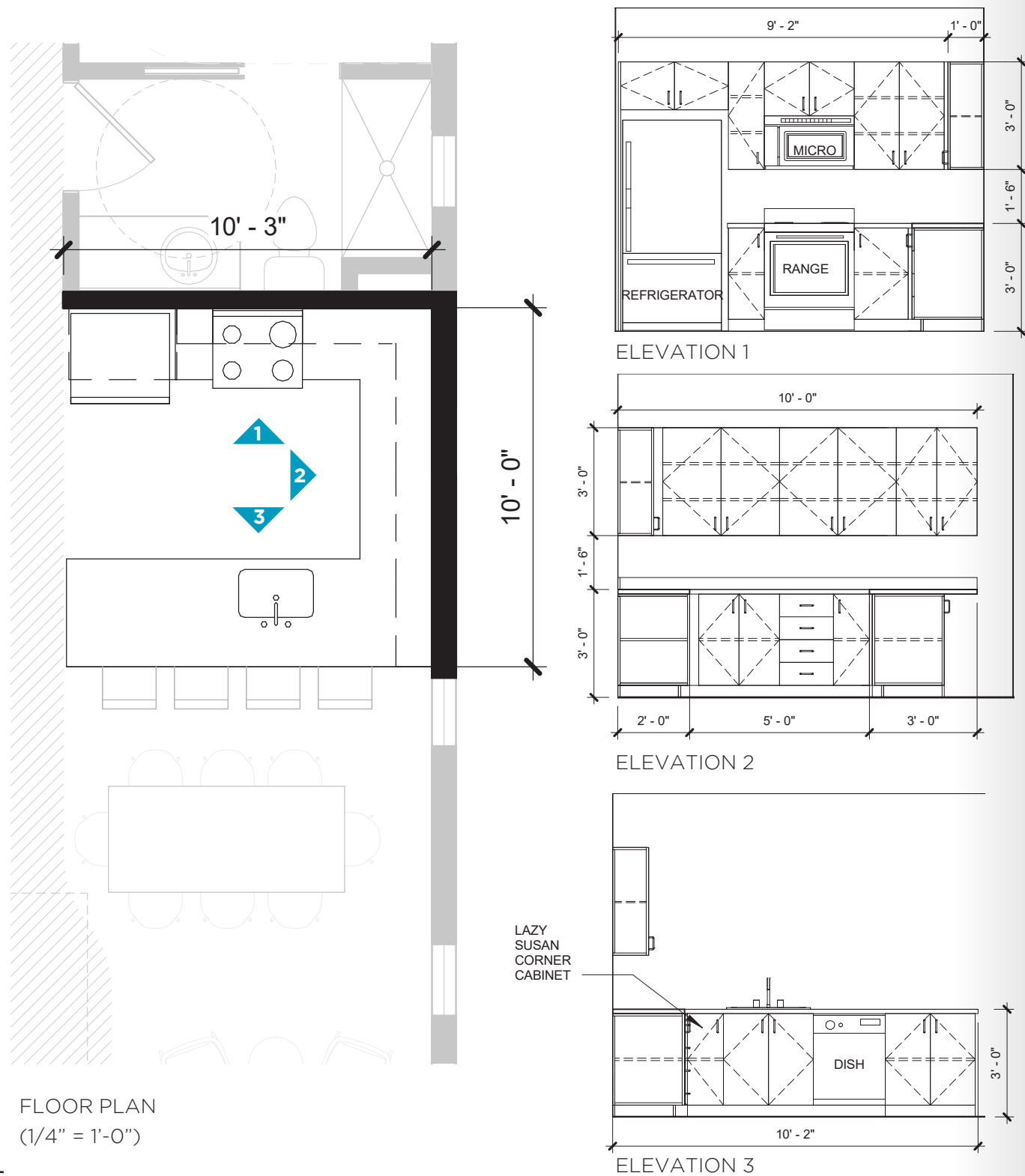


ELEVATION 2

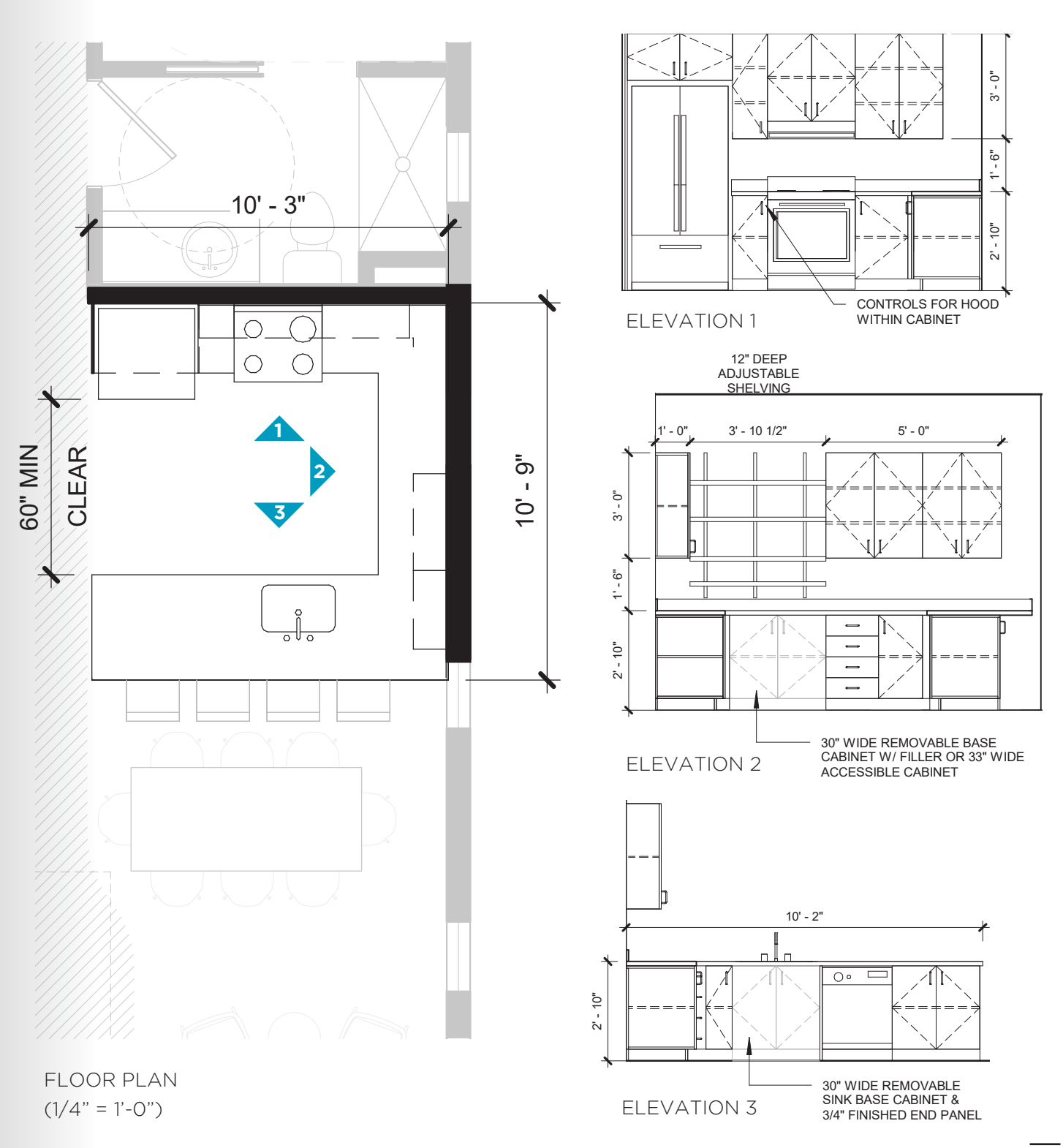
FLOOR PLAN
(1/4" = 1'-0")

Interior Components *continued*

Kitchen Layout U-Shaped

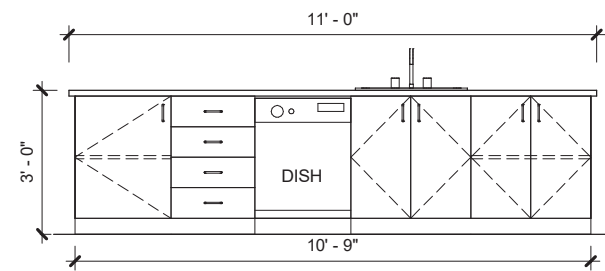
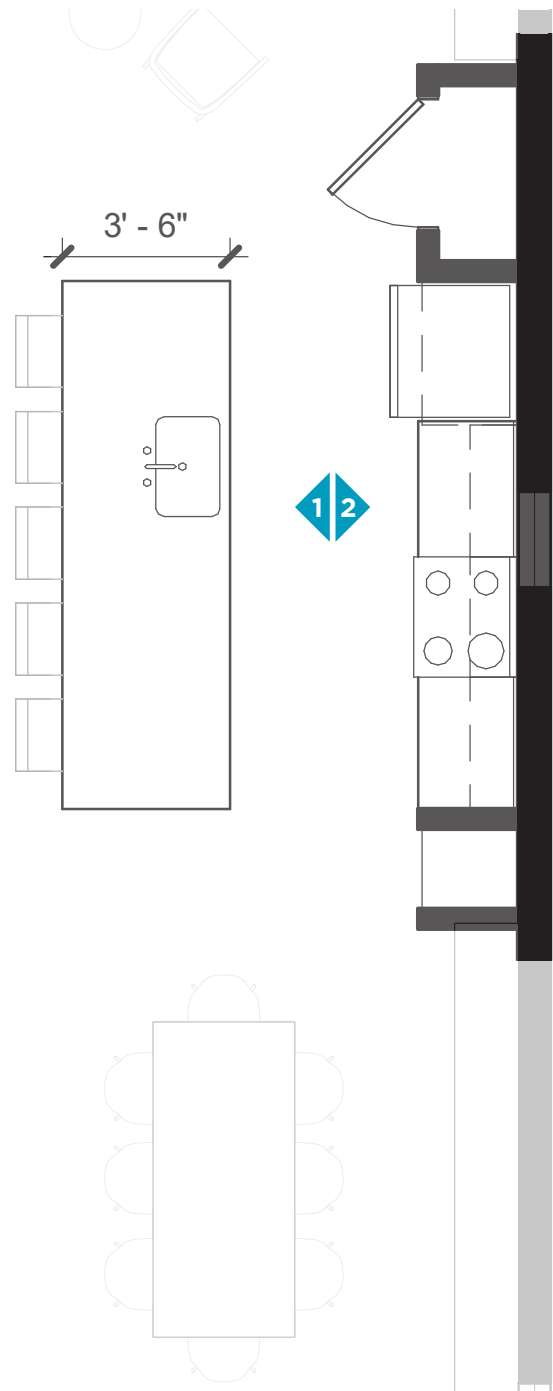


Kitchen Layout U-Shaped, Modified

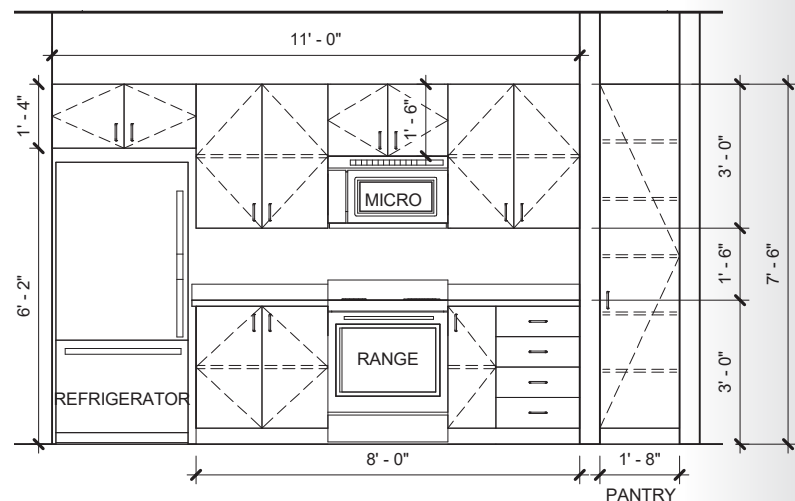


Interior Components *continued*

Kitchen Layout Galley Long



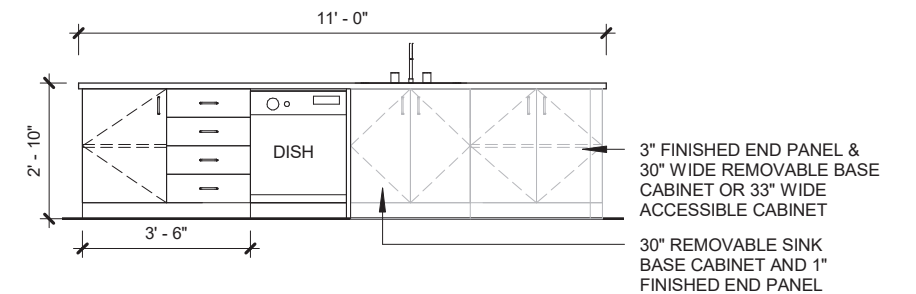
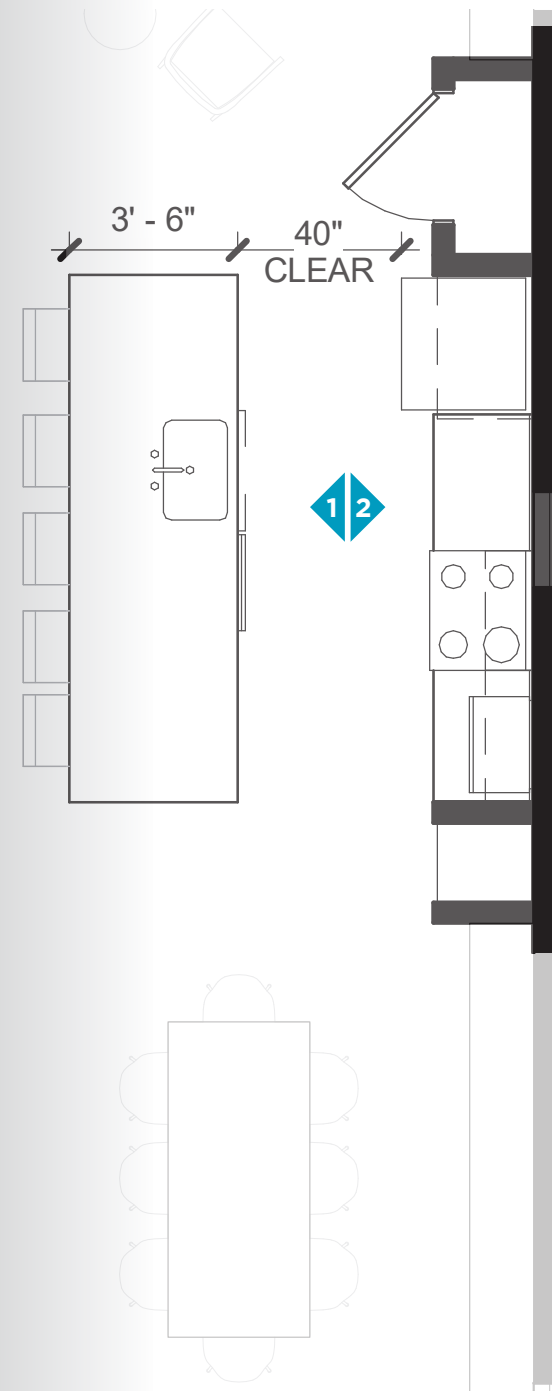
ELEVATION 1



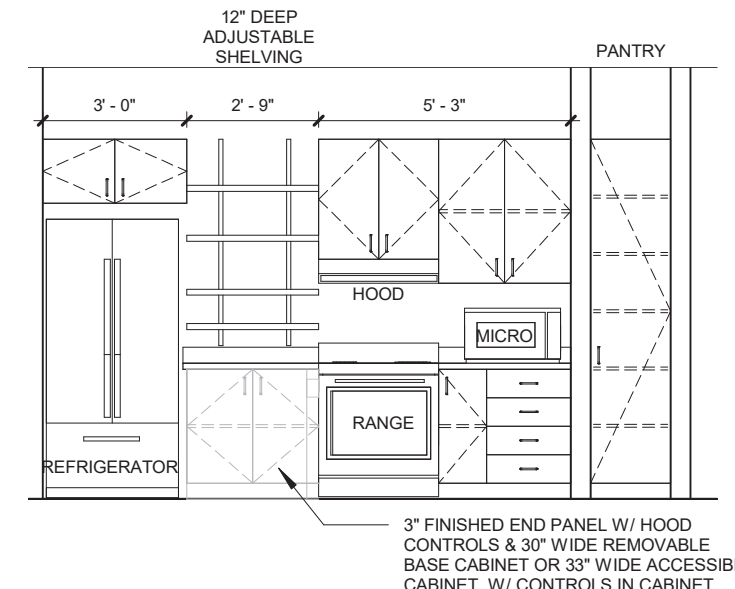
ELEVATION 2

FLOOR PLAN
(1/4" = 1'-0")

Kitchen Layout Galley Long, Modified



ELEVATION 1

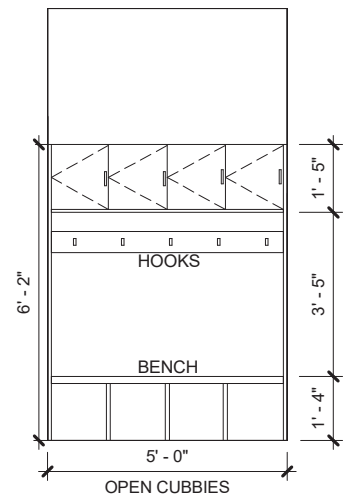


ELEVATION 2

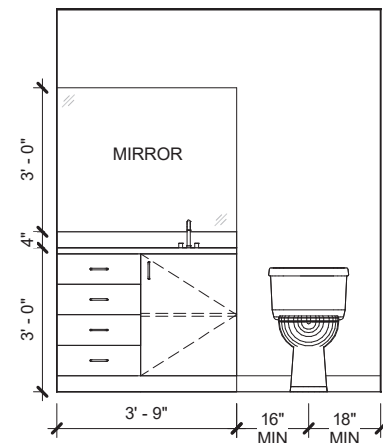
FLOOR PLAN
(1/4" = 1'-0")

Interior Components *continued*

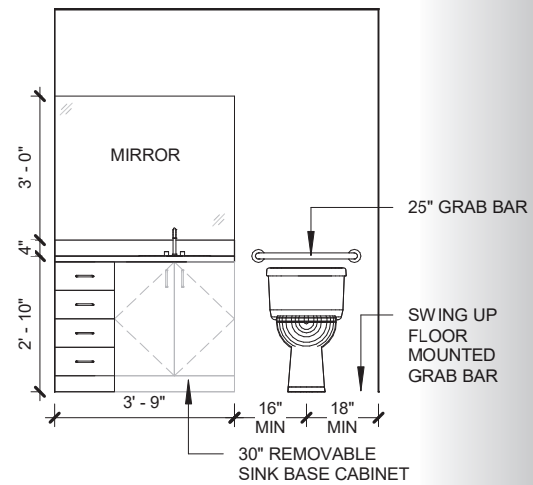
Additional Casework Options



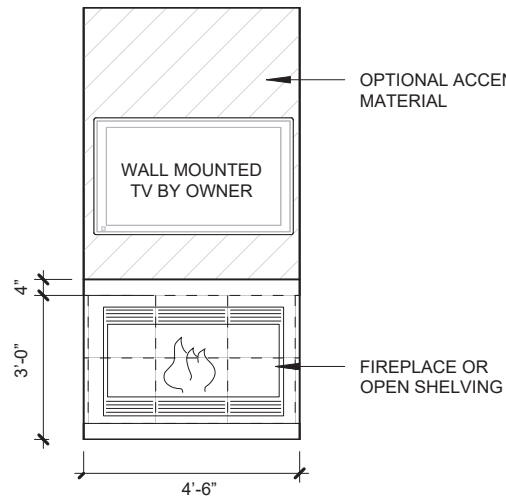
DROP AREA



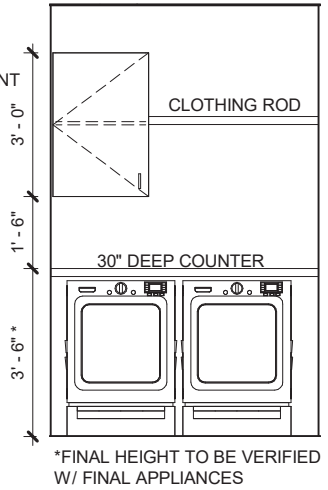
BATHROOM



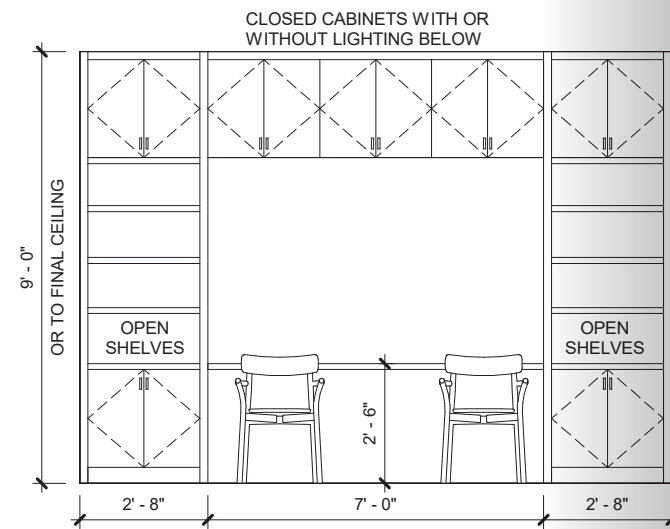
BATHROOM - ACCESSIBLE



TV BUILT IN SURROUND



WASHER/ DRYER ZONE



BASEMENT FAMILY ROOM CASEWORK

Appendix

Stakeholder Engagement

Family Housing Advisory Services (FHAS) Staff Input

Representatives of Omaha by Design, Seventy Five North, and Alley Poyner Macchietto met with staff from FHAS virtually on June 2, 2021 to discuss the needs and expectations of current FHAS program participants. Below are the notes from this exchange.

- Typical program participants have a five- to six-person family; multi-generational families are not the norm.
- New construction is preferred to existing homes.
- 3-5 bedrooms required.
- Garage is preferred.
- Plan for future improvements--provide unfinished basement with plumbing stubs; future additions; etc.
- Quality outdoor spaces are a critical factor--patios, gardens, etc.
- Low long-term maintenance efforts and costs are very important.
- Design/Style
 - Typically design preferences aren't discussed due to the lack of quality options in the current housing market; program participants have limited options.
 - Clients do prefer homes that blend into the neighborhood to a certain

degree--they don't want a home dramatically different from adjacent houses, to the degree that their home sticks out.

- Should provide different elevations, styles, etc., so that there are a variety of options.
- Allow homeowners to participate in the home design.

Investigate small options that could make the home appropriate for more owners; enclosed kitchens, etc.

Family Housing Advisory Services (FHAS) Participant Survey

A survey for FHAS program participants was created to help identify what potential homeowners within the market are looking for in an ideal home. The survey was distributed to program participants and current Highlander residents, and a total of 20 people participated in June and July of 2021. Below are the summarized results of the survey.

- Most typical household size consists of four people (31.25%), followed by three (25%), and two (25%).
- Most households do not currently host multiple generations, although interest in multi-generational features was expressed.
- Typical homebuyer is looking for either a three bedroom (56.25%) or four

bedroom (50%) home. There was zero interest in a home with two or fewer bedrooms; one respondent noted that they are looking for a five bedroom home.

- 50% of respondents are looking for homes within the range of \$100,000-\$120,000 dollars; 25% are looking for \$140,000-\$160,000.
- Number of bedrooms is the most important characteristic when potential homebuyers are evaluating a house, followed by yard size, design characteristics, neighborhood quality, being close to work, having an enclosed garage, and access to alternative means of transport (listed in order of priority).
- Additional features that respondents would like to see include a finished basement, more than one bathroom, bonus rooms/spaces, a fireplace, two-car garage, and front and back porches.
- 56.25% of respondents noted that they would be interested in a Home Owner's Association that charges \$50/month and covers lawn maintenance and mowing, as well as snow removal. Reasons for interest include homeowner mobility and age, which can make lawn care more difficult, and the reasonable cost.
- Respondents' weighted importance for a large yard was 60 out of 100.

- Respondents' weighted importance for a garage was 80 out of 100, with vehicle parking as the primary intended use, along with storage of lawn equipment. The majority of respondents (68.75%) noted that a carport would not be an acceptable substitute for an enclosed garage.
- Respondents' weighted importance for a basement was 83 out of 100. Alternative storm shelter options were deemed unacceptable as a replacement for a basement.
- Garage, basement, and closet storage were all relatively even in importance.
- Majority of respondents (75%) are interested in front and back patios/porches, the additional quarter of respondents prefer a back patio.
- 62.5% of respondents would like a place to garden within their own property.
- Respondents' weighted interest in a shared courtyard, garden, or driveway was 16 out of 100.
- For future additions/renovations, respondents are most interested in an enhanced patio or garden (37.5%), a suite for extended family (31.25%), and additional bedrooms (12.5%). The remaining respondents were not interested in future additions.

Stakeholder Engagement *continued*

- Frustrations within the current housing market include:
 - Poor quality
 - Too few bedrooms
 - Cost
 - Small living spaces
- Preferred housing materials, in order of preference, are: brick, siding, concrete, concrete block, metal panel, wood, plaster, and shingles.
- Interior finish priorities were evenly distributed among: durability, cleanability, comfort, acoustics/sound privacy, appearance, and sustainability.
- 86.67% of respondents would like the option to choose interior and exterior finishes and paint colors.
- On a scale of 1 being traditional, and 100 being modern, respondents' averaged preference was 68, with the majority of people ranking their preference at around 50, and a secondary cohort strongly preferring a modern option.
- Respondents' averaged interest in an open layout was 53 out of 100, with 0 being a traditional layout with separate rooms, and 100 being an open-concept. The majority of respondents responded strongly toward the two options, with only 5 of 13 respondents answering with a neutral preference.

Realtor Input - Angel Starks

Following are notes from a conversation between Angel Starks, a Realtor familiar with the overall Omaha market as well as the area proximate to the Highlander development, and Megan Lutz of APMA.

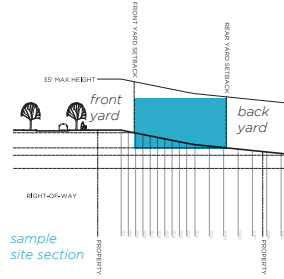
- Have multiple design options to avoid a neighborhood with one or two repeated designs. Potential homeowners prefer this both for the unique character, but also for variety in floor plans and security.
- No galley kitchens--potential homeowners hate them, and prefer to have an island with seating.
- Provide dining areas outside of the immediate kitchen, along with creative and flexible solutions for large gatherings/meals/holidays.
- Minimum one car garage, two is preferred.
- Provide design options for pets, such as a fenced in backyard.
- Design primary bedrooms to accommodate a king-size bed.
- As much natural light as possible--provide graciously sized windows in strategic locations; be aware of sight-lines from neighboring houses. Skylights or light tubes would also be an elevating factor. Plan for how the windows will be cleaned.
- Side by side washer and dryer.

- Provide opportunities for homeowners to age in place; provide an option that is all one level, or at least has a primary suite with shower on the ground level.
- Provide a secondary living space/family room in the basement. Plan for secondary spaces for kids. Tri-level homes can be great for this.
- Accommodate a desk/office space for working from home.
- Provide or locate a site for a storage shed outside of the garage.
- Provide plenty of storage, including a pantry, linen closet, coat closet, as well as a general storage/utility room.
- No split levels.
- Provide ceiling fans, or the power for them, to be installed later in bedrooms, kitchens, dining, and living areas.
- Use space creatively--i.e., provide a bench/seating area on a stair landing as a place that a child could sit and read, provide options for converting closets into efficient desk spaces, etc.
- Create an entryway/drop-zone at the front door that is either separate from the living spaces or defined through casework/partial height walls/etc.
- Include USB outlets in most locations.

- Consider pocket doors--while they can be a maintenance item, their space efficiency may be worth it in some applications.
- Prioritize long-term maintenance--pre-finished materials, etc.

Sample Floor plans

The Burdette



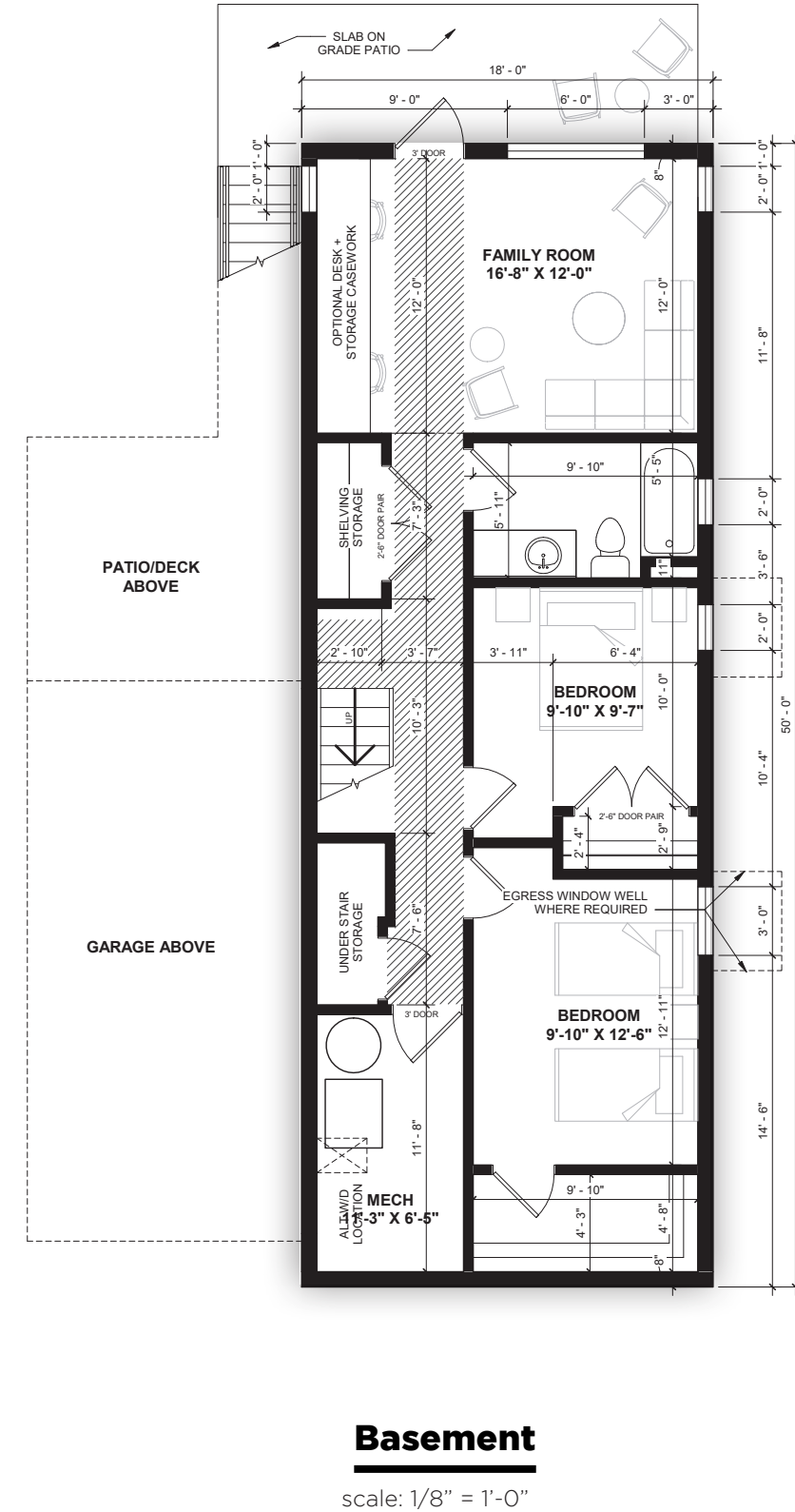
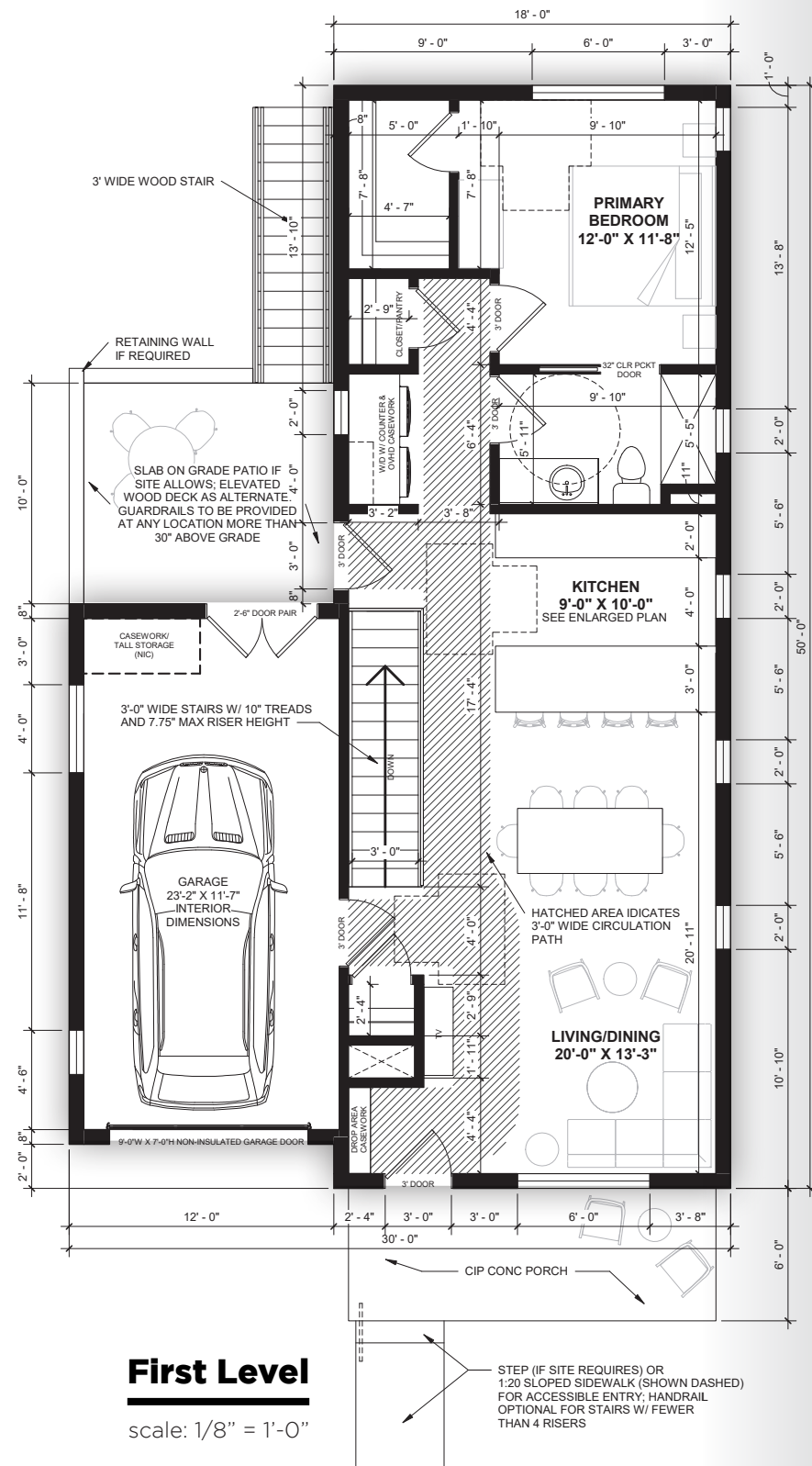
3 Bed/2 Bath Walk-Out Basement on a Narrow Lot
Primary Bedroom and Laundry on Main Level

| | |
|--------------|----------------|
| Main Level | 900 sf |
| Basement | 900 sf |
| Total | 1800 sf |

Garage 295 sf

Notes:
Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.

Typical conditions and site information on these plans apply to following plans unless noted otherwise.



Sample Floor plans

The Parker

3 Bed/2 Bath Single Story Home w/ Optional Basement on Typical Lot (50')

Main Level 1592 sf
Basement 1286 sf
Total 2878 sf

Garage 343 sf

Minimum 44' wide lot if porch doesn't wrap side wall.

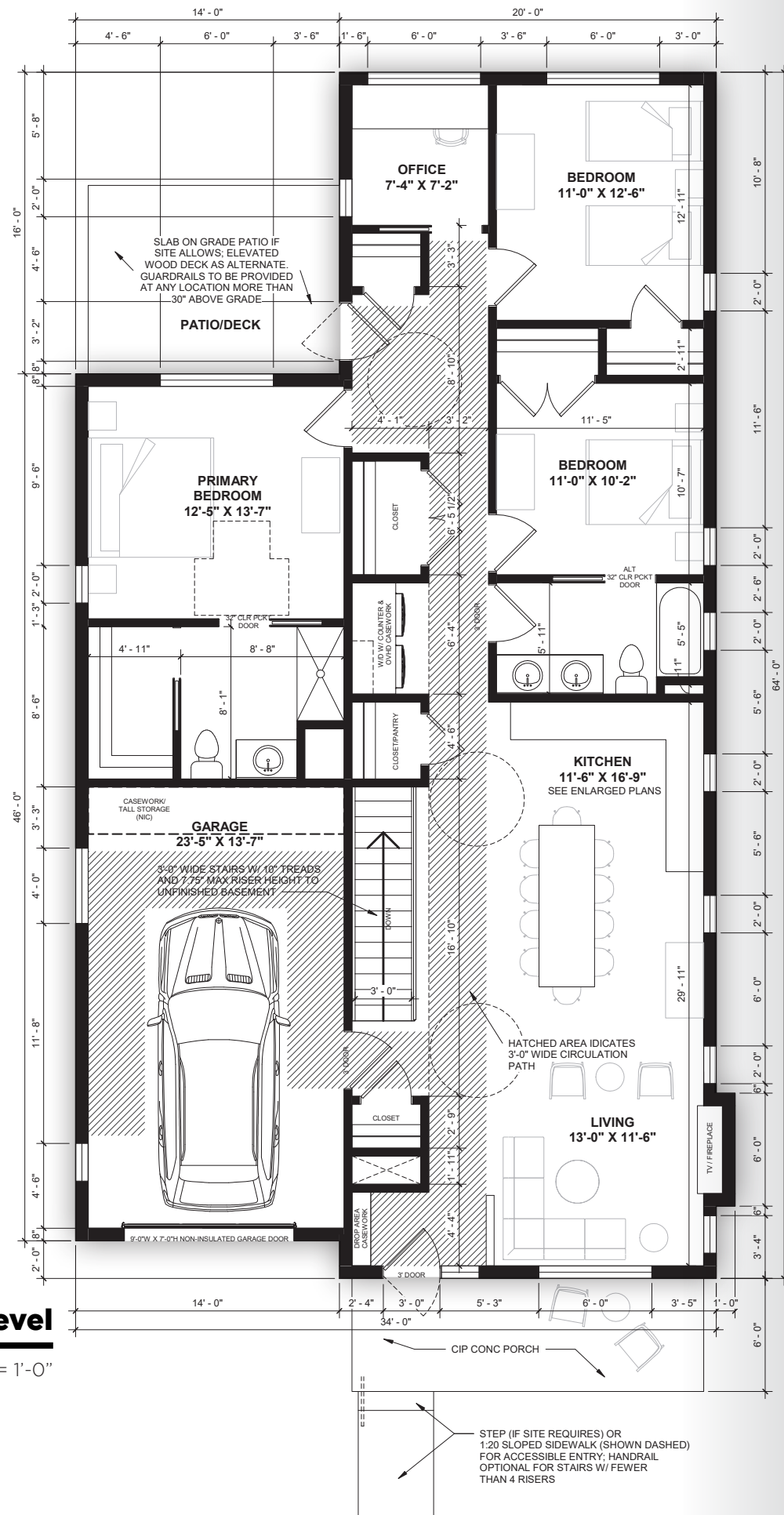
OR

Single Story Slab on Grade

Main Level 1592 sf

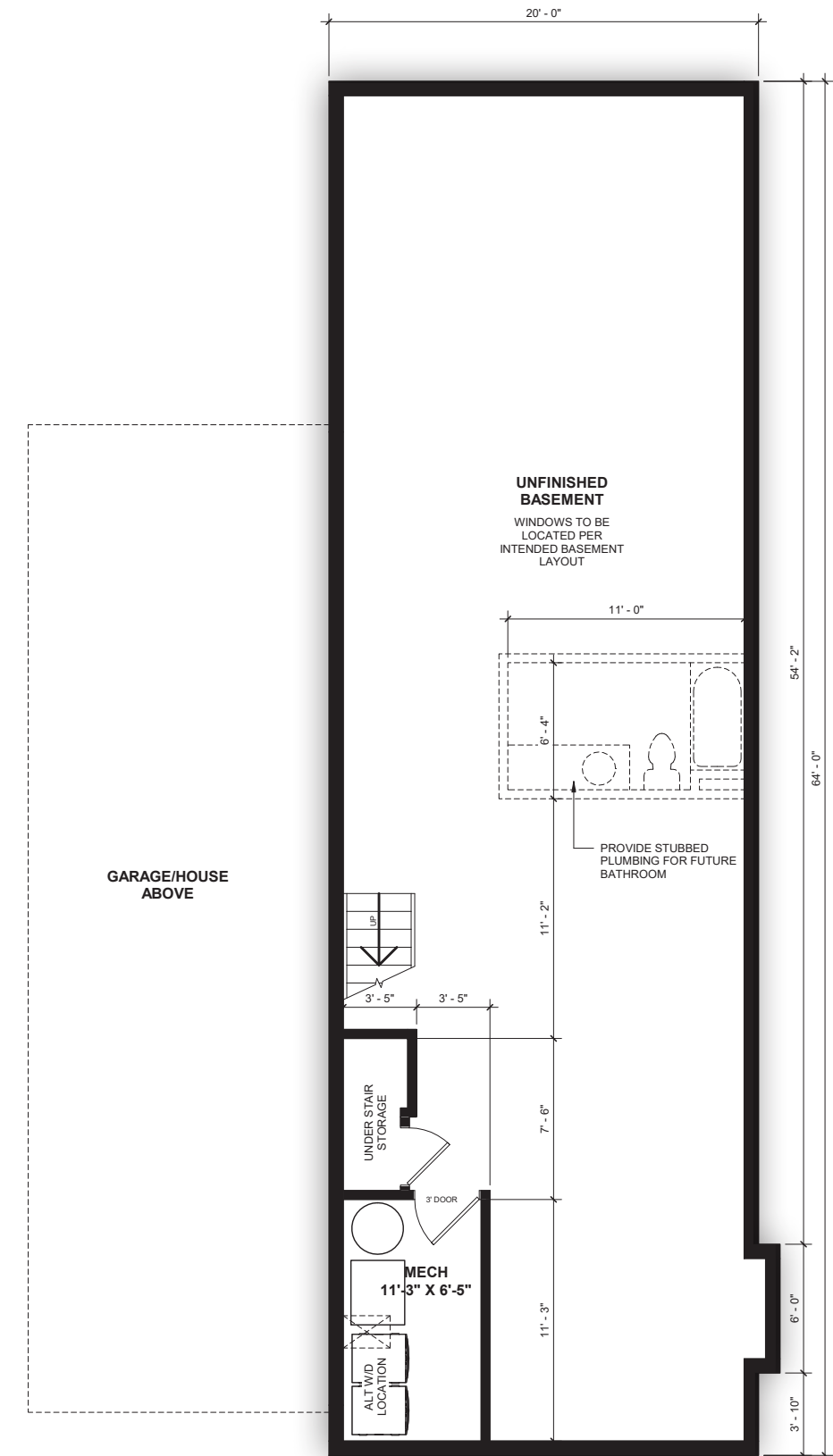
Garage 343 sf

Assumes interior bathroom would be reinforced for storm protection.



First Level

scale: 1/8" = 1'-0"



Basement

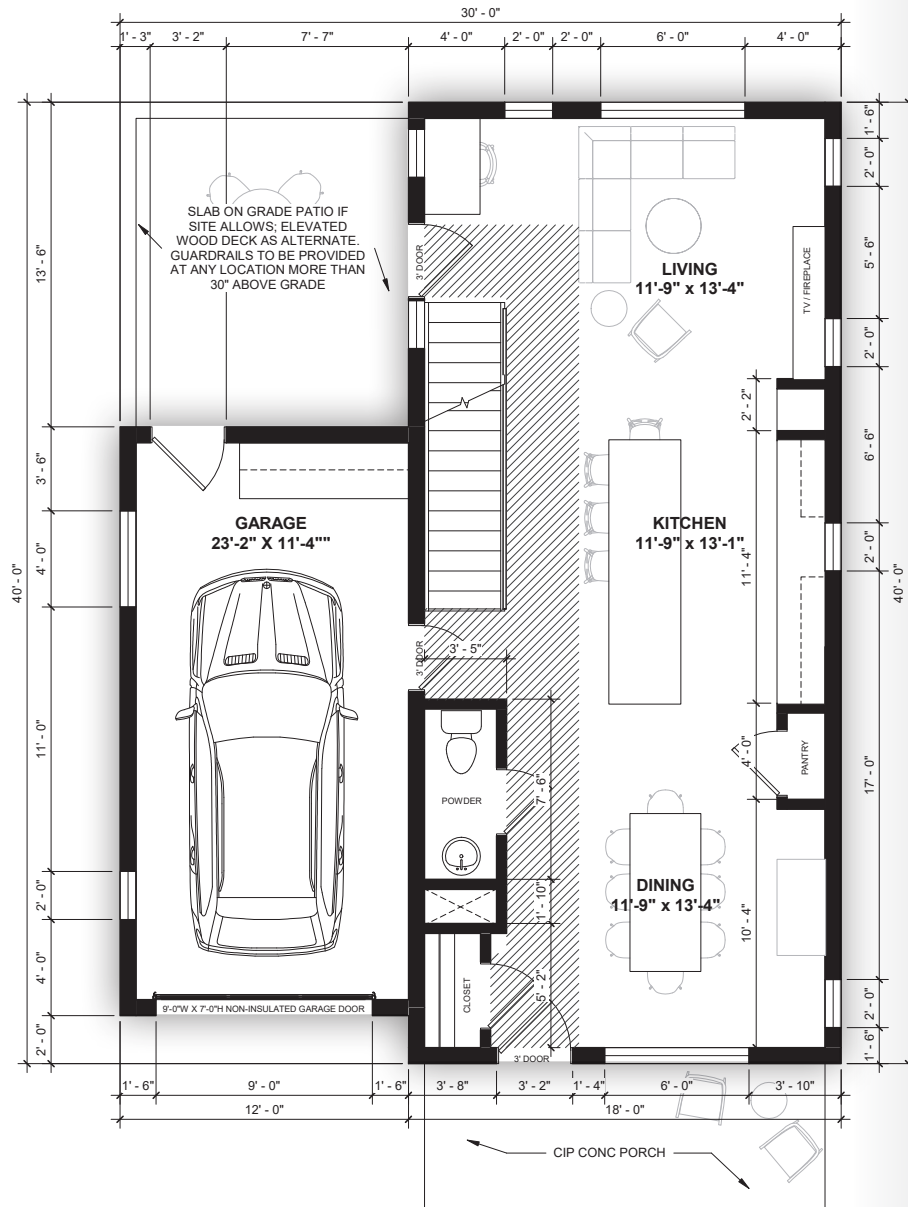
scale: 1/8" = 1'-0"

Sample Floor plans

The Patrick

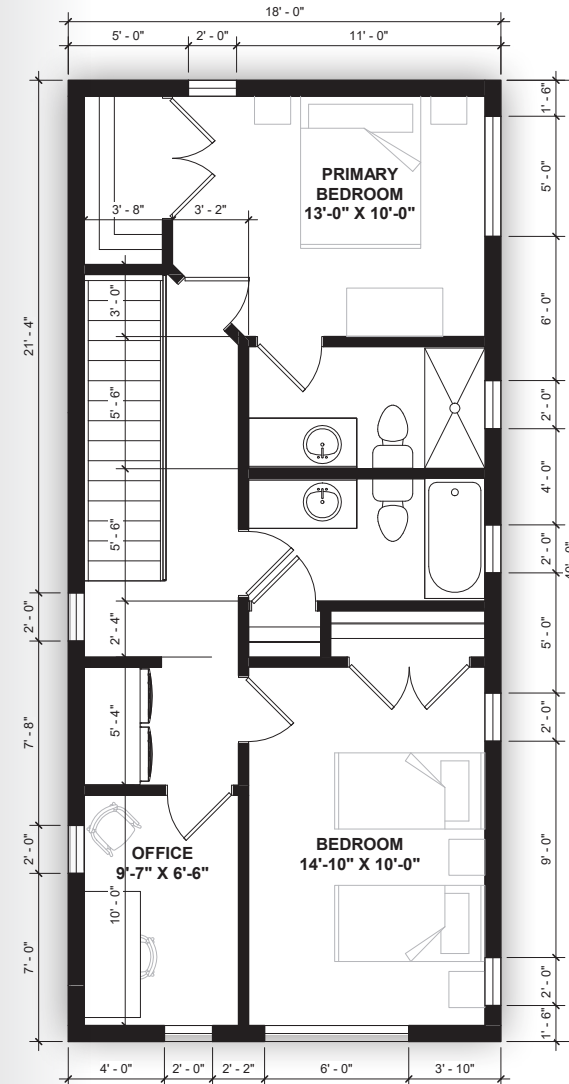
2 Bed/2.5 Bath Two-Story Home w/ Basement on Narrow Lot (40')

| | |
|--------------|----------------|
| Main Level | 720 sf |
| Upstairs | 720 sf |
| Basement | 720 sf |
| Total | 2160 sf |
| Garage | 295 sf |



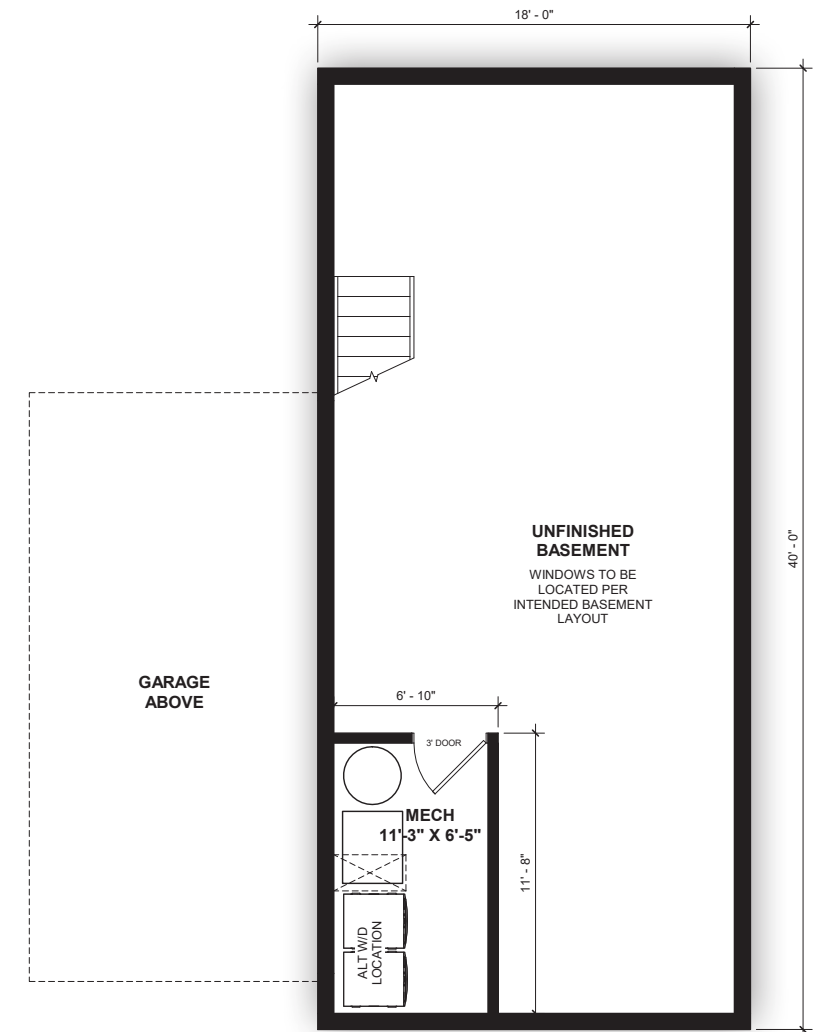
First Level

scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"



Basement

scale: 1/8" = 1'-0"

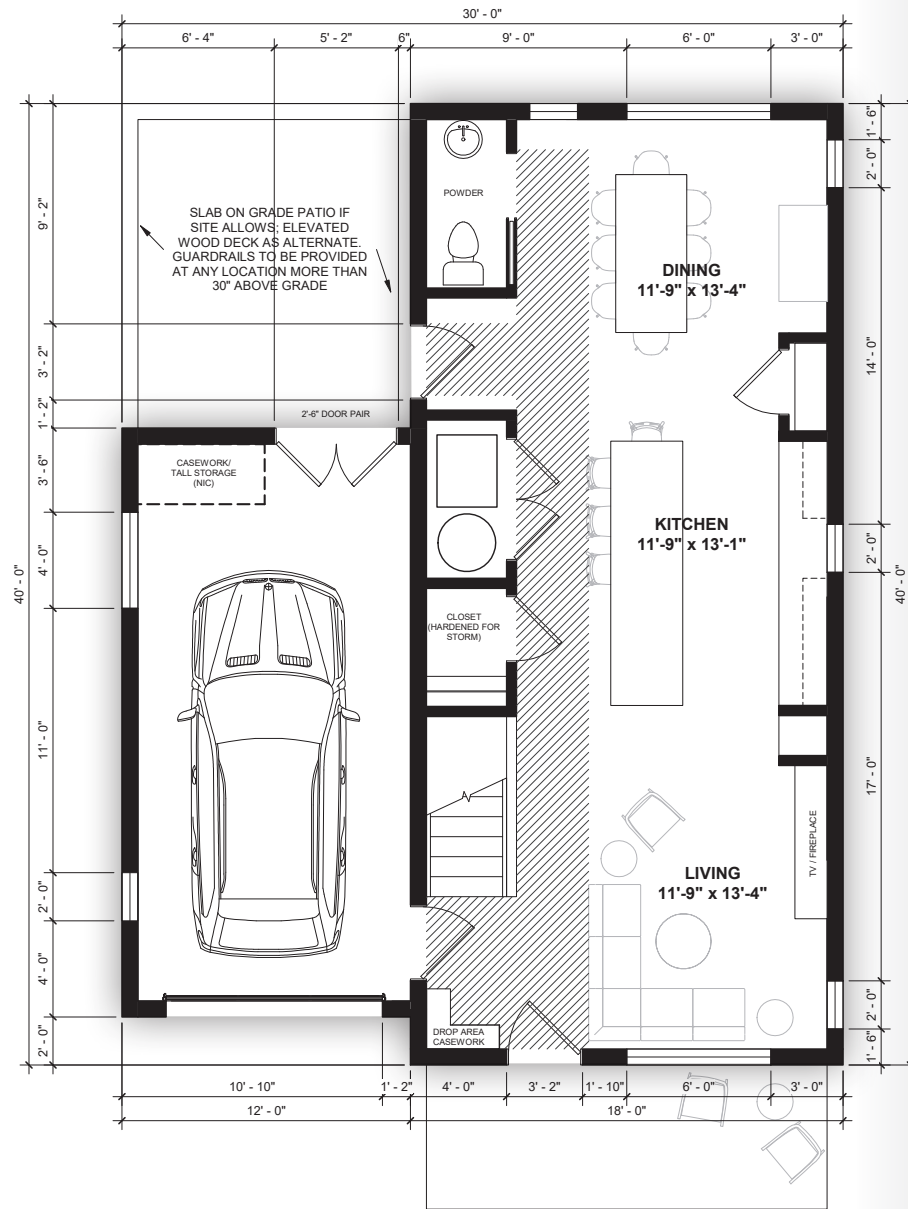
Sample Floor plans

The Patrick

Alternate 1 - No Basement

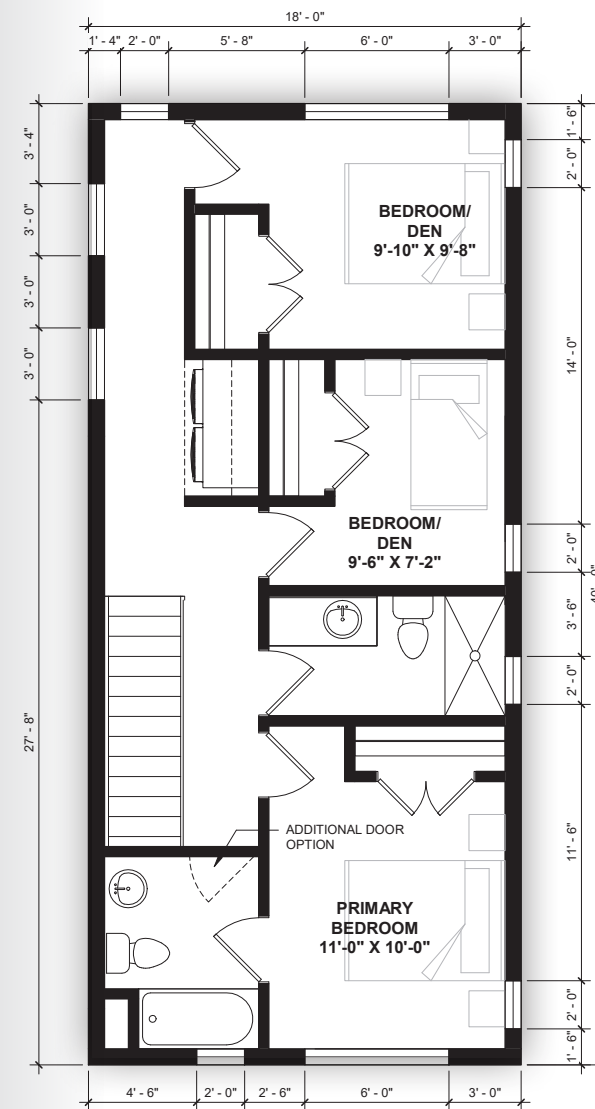
3 Bed/2.5 Bath Two-Story Home w/ no Basement on Narrow Lot (40')

Main Level 720 sf
 Upstairs 720 sf
Total 1440 sf
 Garage 295 sf



First Level

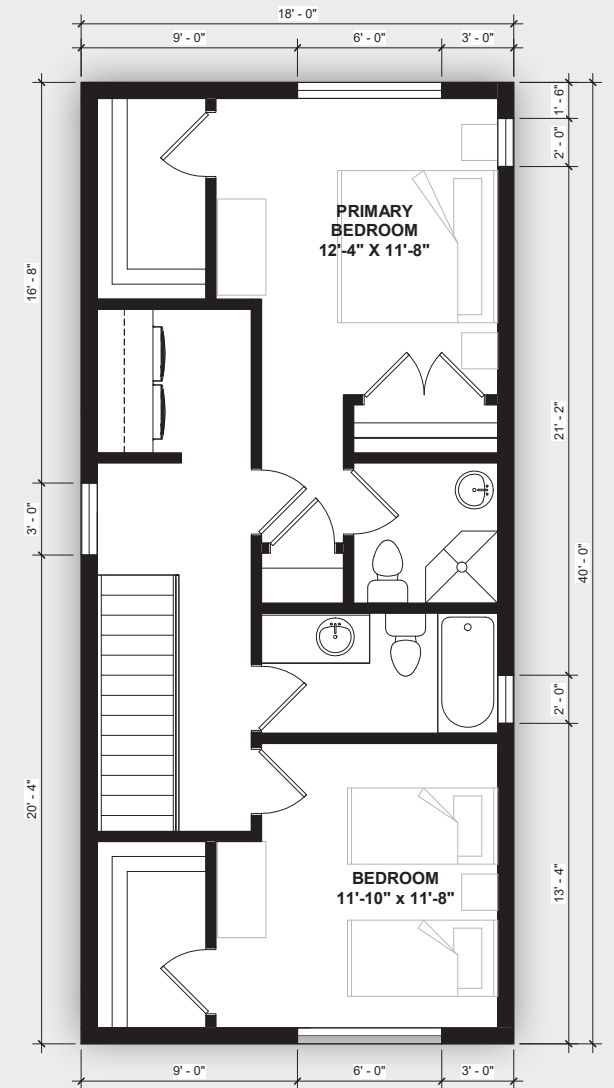
scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"

Alternate Upper Level



Second Level

scale: 1/8" = 1'-0"

Sample Floor plans

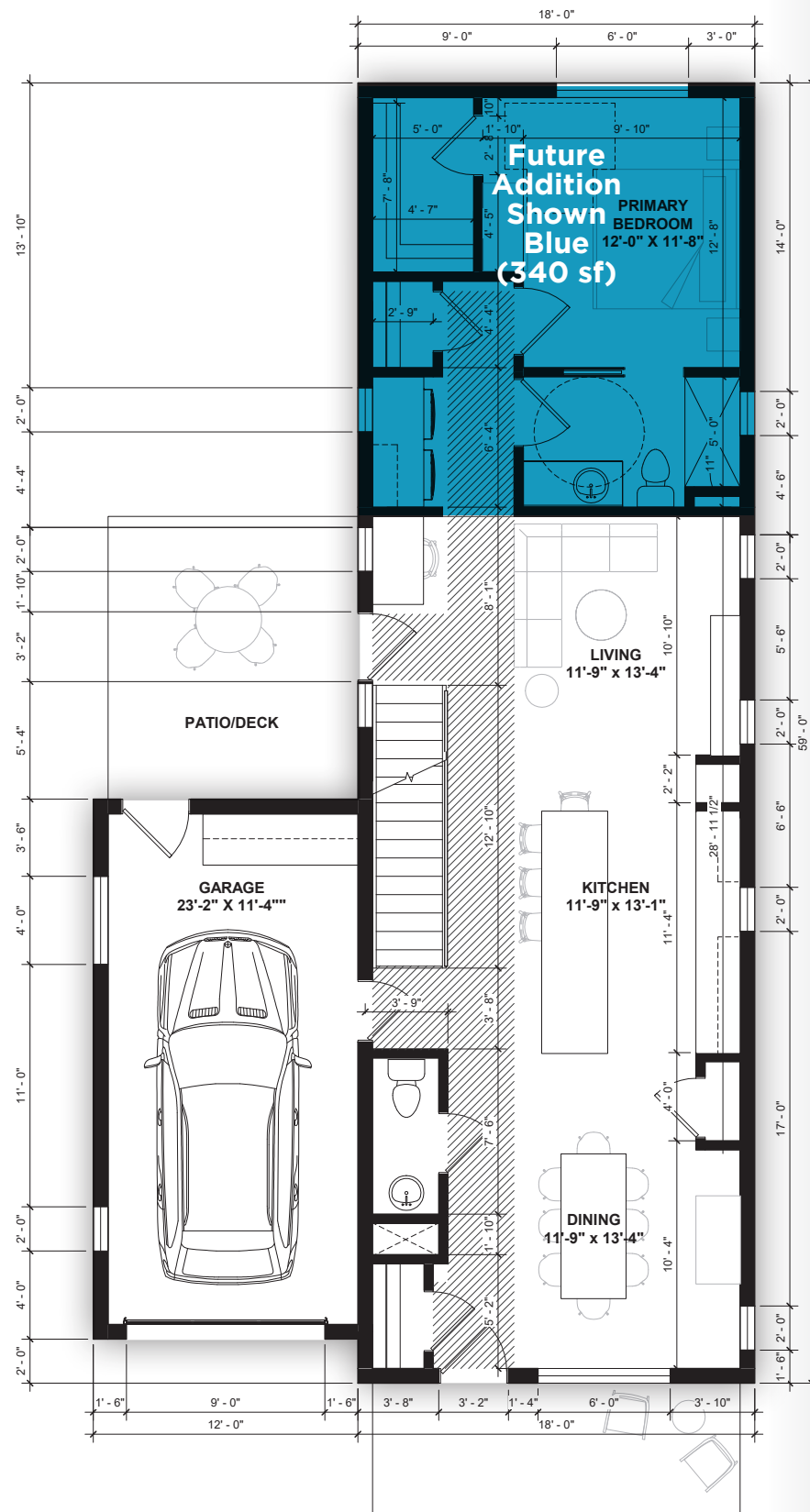
The Patrick Alternate 2 - Future Addition of Main Level Primary Bedroom

3 Bed/3.5 Bath Two-Story Home w/ Basement on Narrow Lot (40')

Example of how a main-level primary bedroom can be added in a future phase.

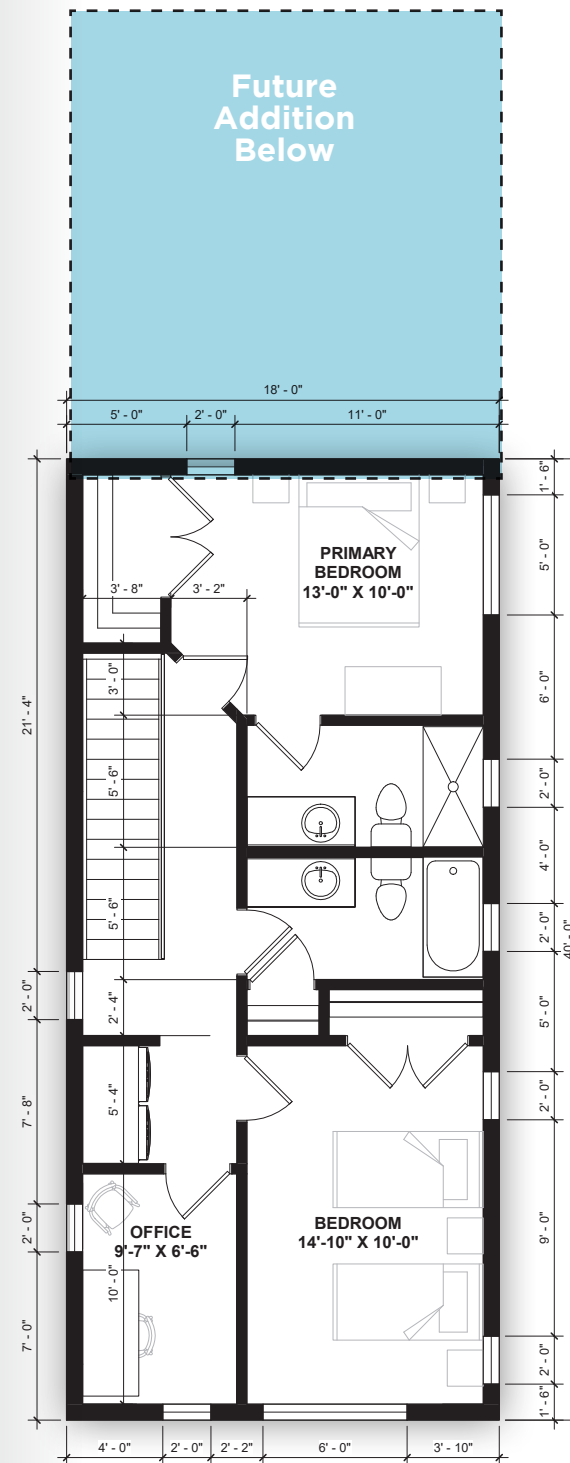
Main Level 1060 sf
(with addition)
Upstairs 720 sf
Basement 720 sf
Total 2,200 sf

Garage 295 sf



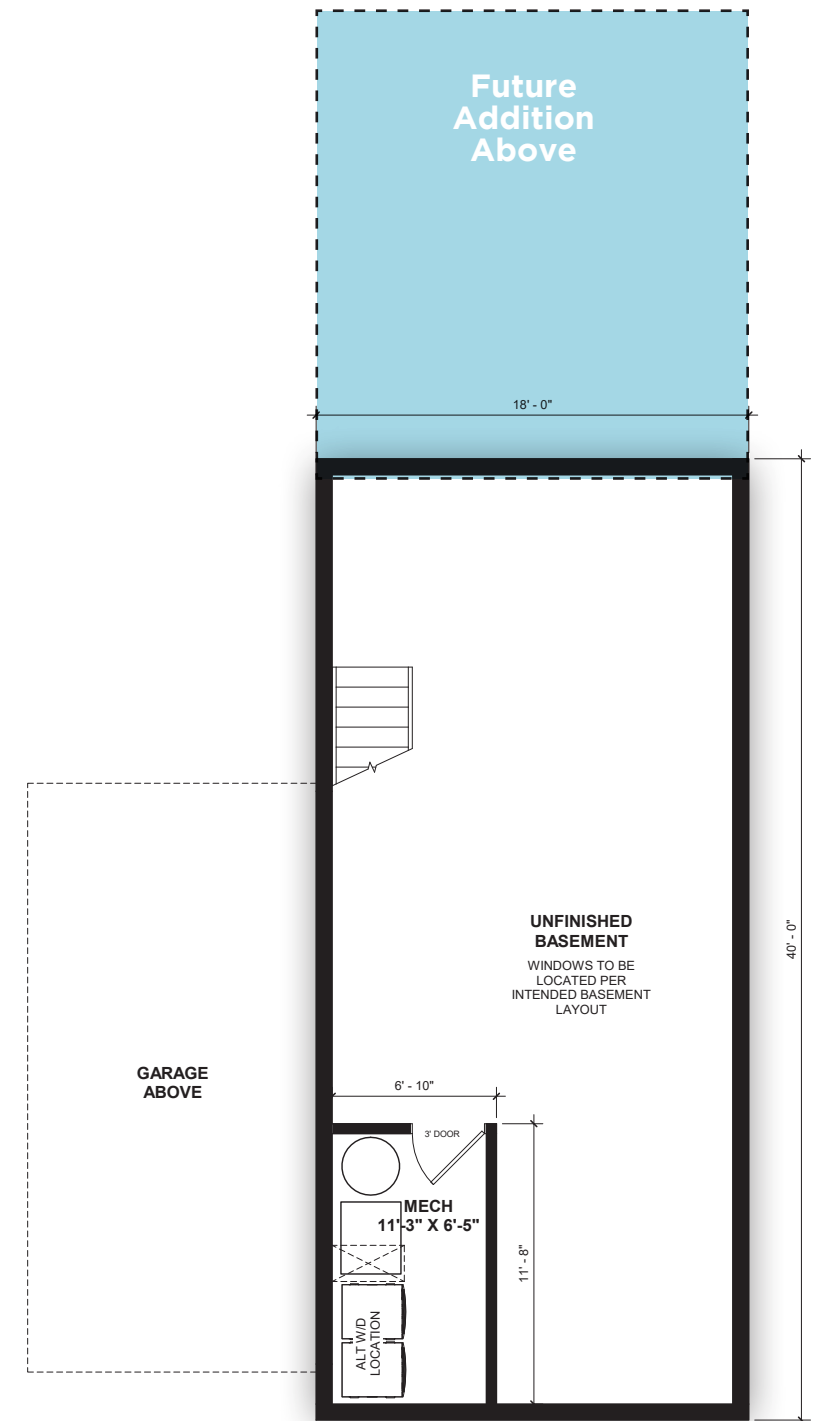
First Level

scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"

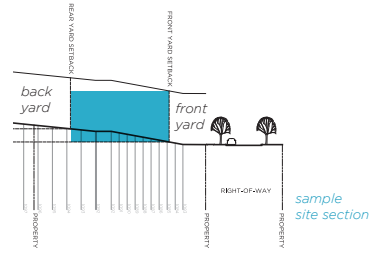


Basement

scale: 1/8" = 1'-0"

Sample Floor plans

The Blondo



“Walk-In Basement”

3 Bed/2 Bath Home w/
Office on Narrow Lot (40')

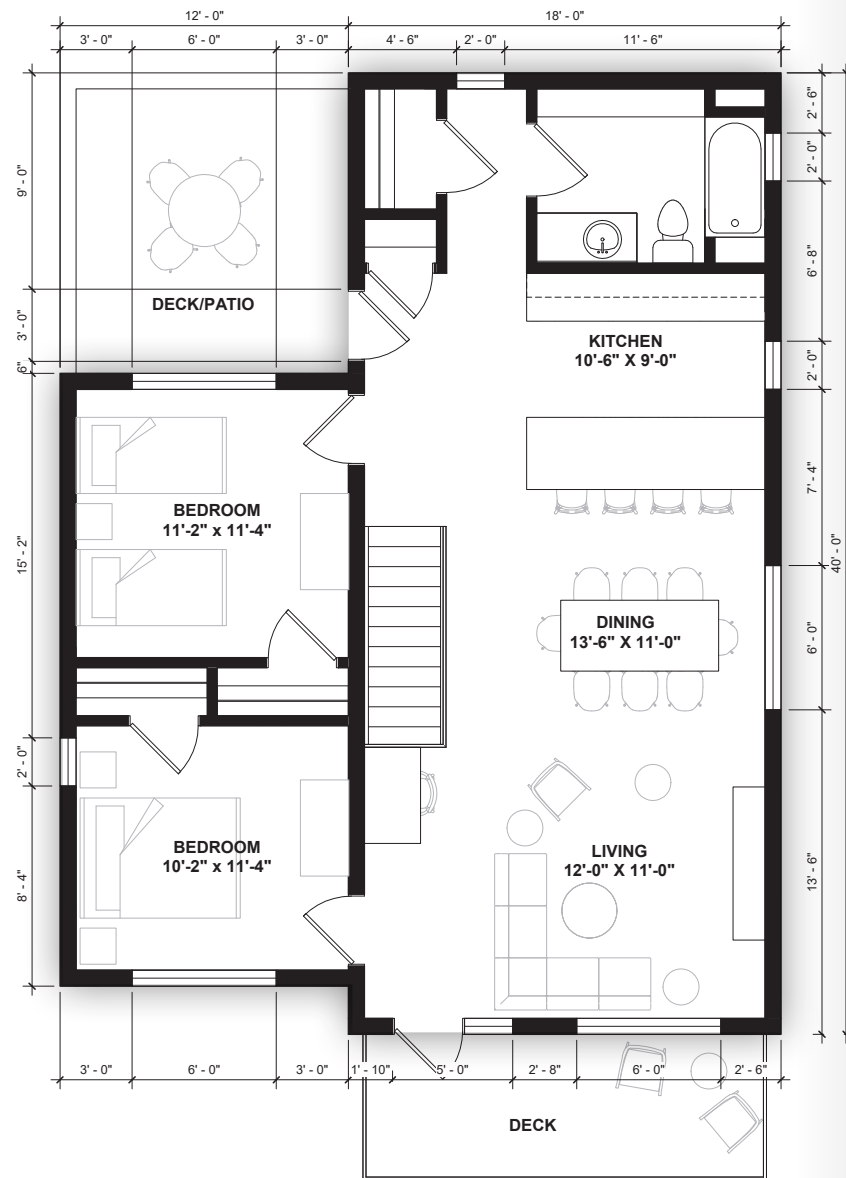
This plan is for homes that are built-into a hill because of site topography.

Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

Garage 306 sf

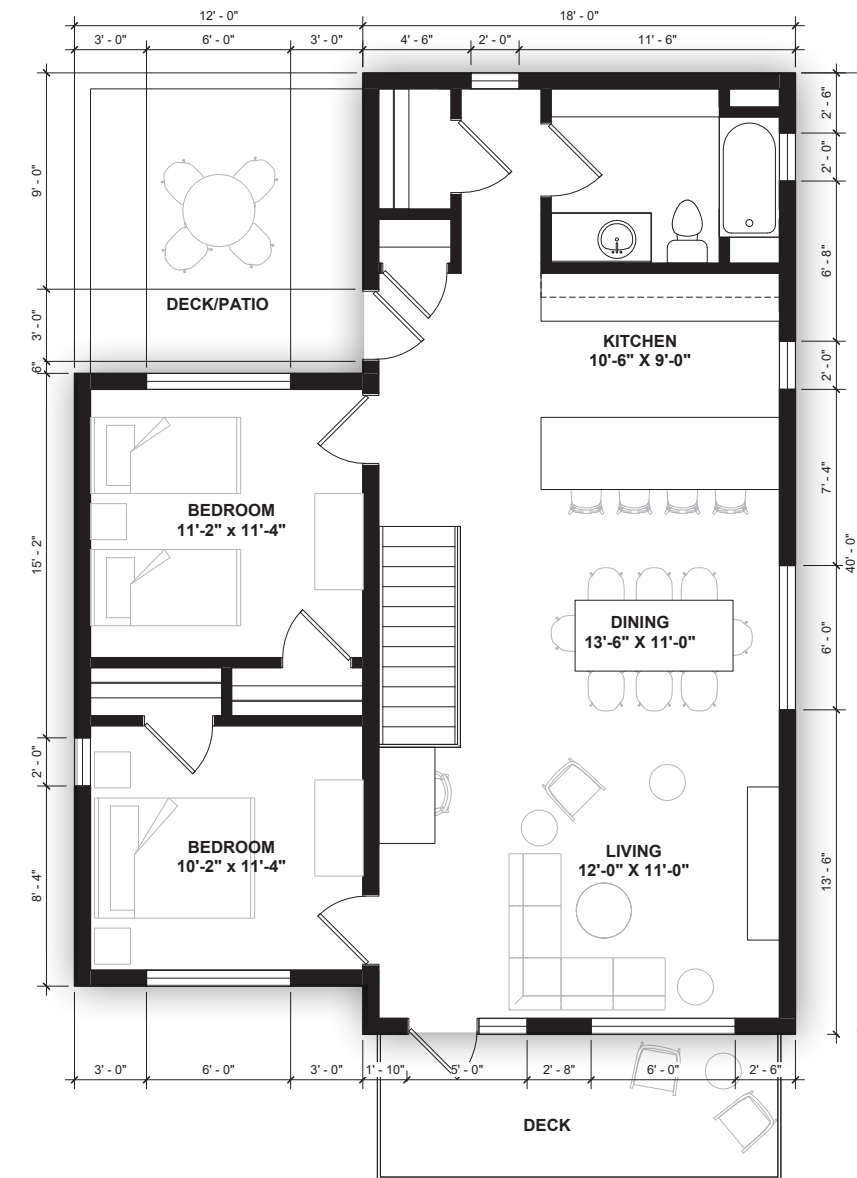
Notes:

Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.



First Level

scale: 1/8" = 1'-0"

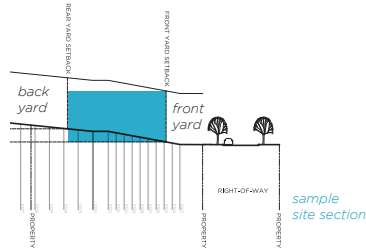


Second Level

scale: 1/8" = 1'-0"

Sample Floor plans

The Blondo Alternate 1 - Partially Enclosed Kitchen

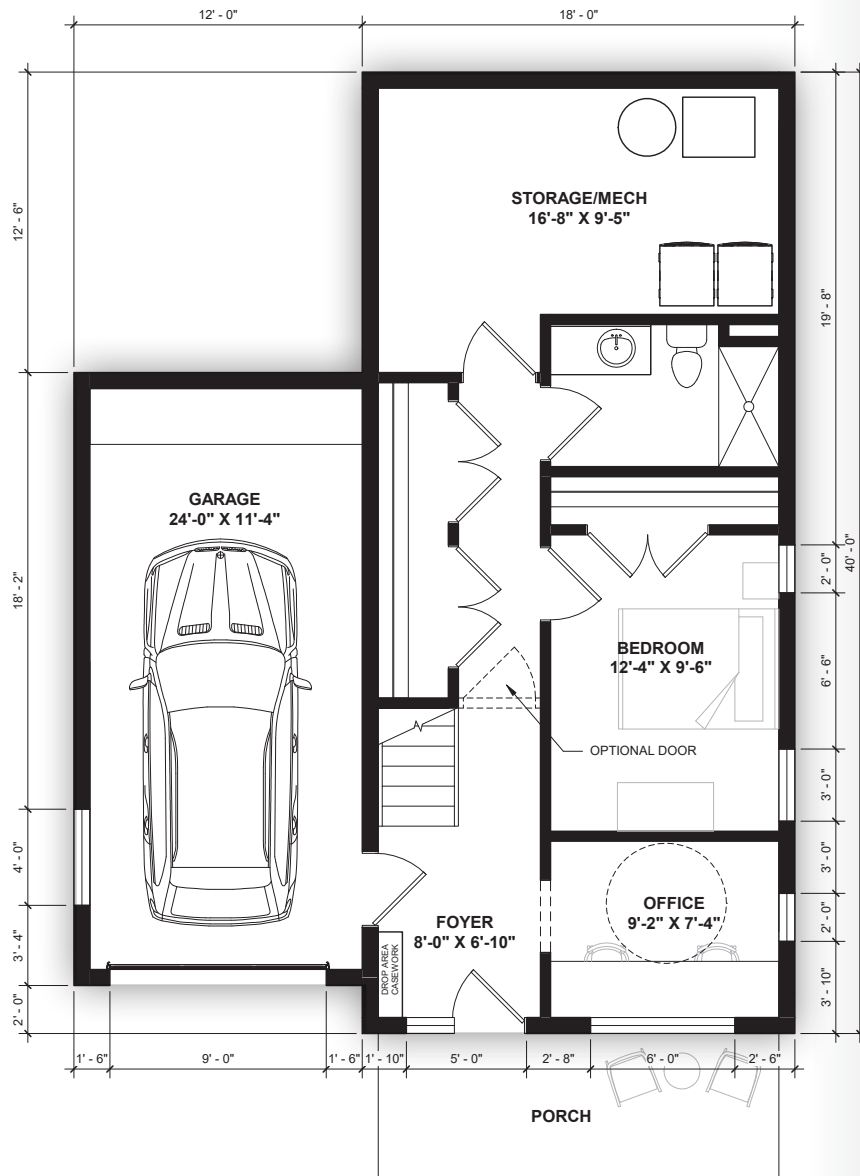


“Walk-In Basement”
3 Bed/2 Bath Home w/
Office on Narrow Lot (40’)
This plan is for homes that are built-into a hill because of site topography.

Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

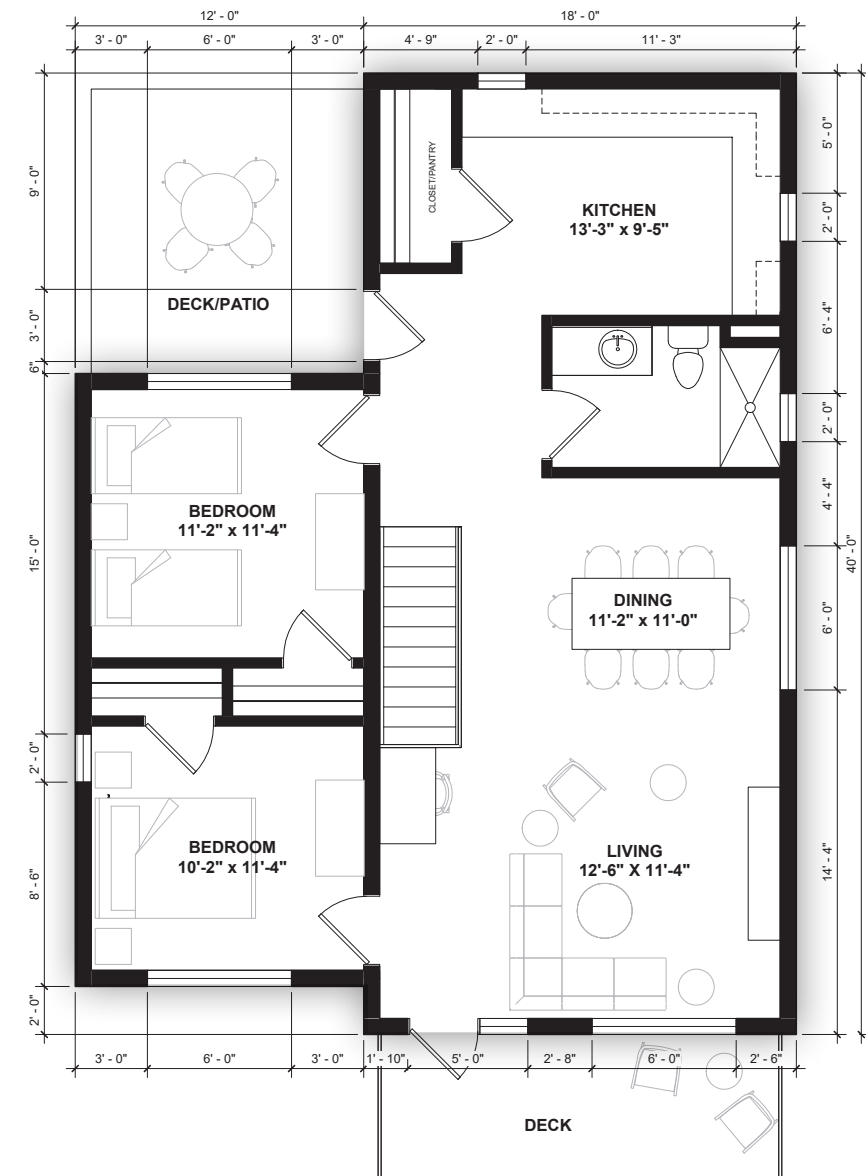
Garage 306 sf

Notes:
Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.



First Level

scale: 1/8" = 1'-0"

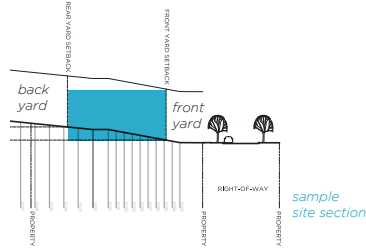


Second Level

scale: 1/8" = 1'-0"

Sample Floor plans

The Blondo Alternate 2 - Partially Enclosed Kitchen w/ Extended Family Suite



“Walk-In Basement”

3 Bed/2 Bath Home, Including Extended Family Suite, w/ Office on Narrow Lot (40')

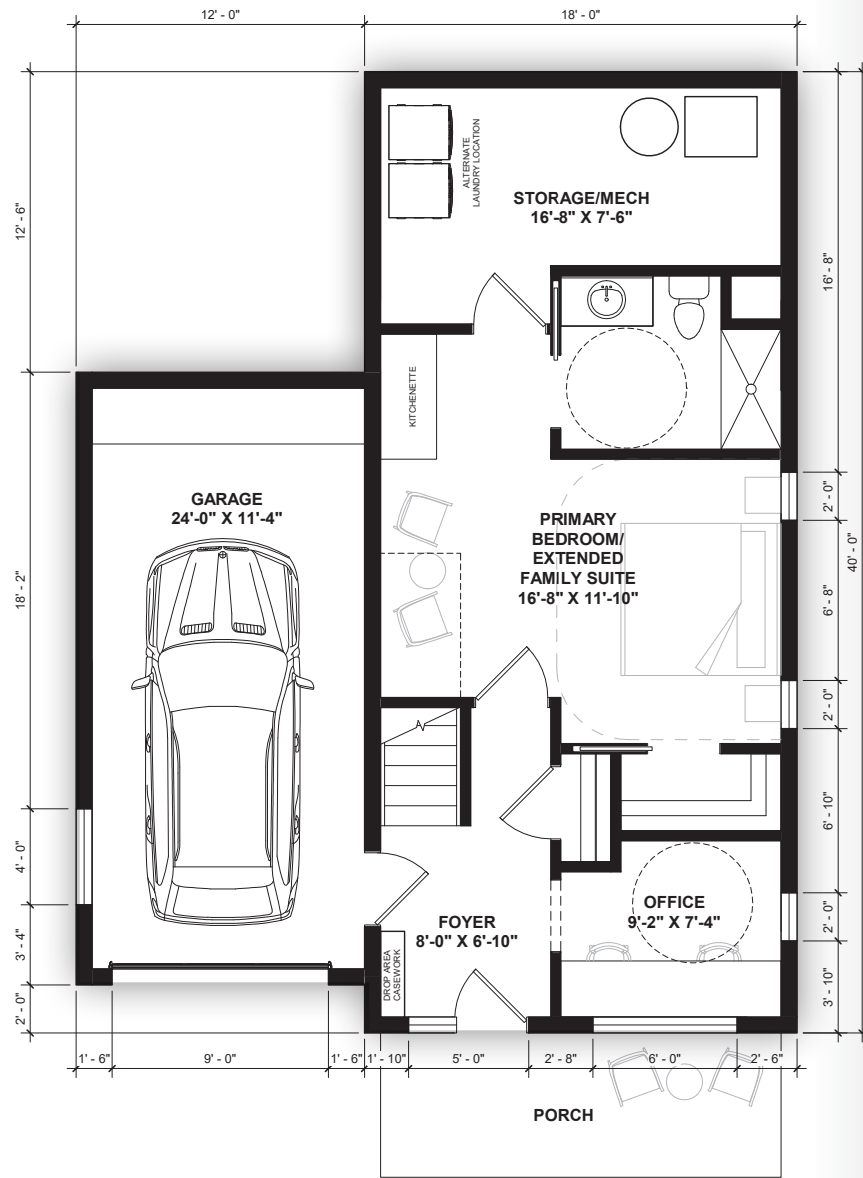
This plan is for homes that are built-into a hill because of site topography.

Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

Garage 306 sf

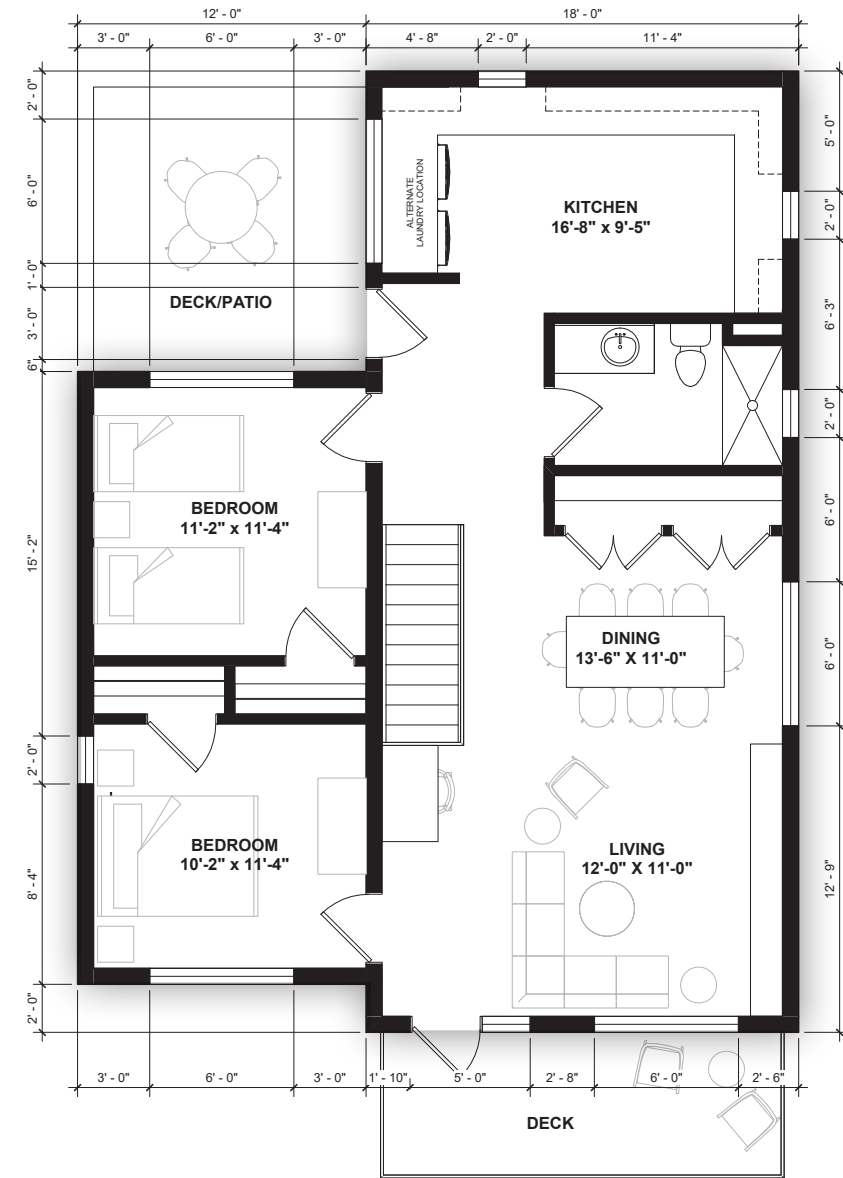
Notes:

Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.



First Level

scale: 1/8" = 1'-0"

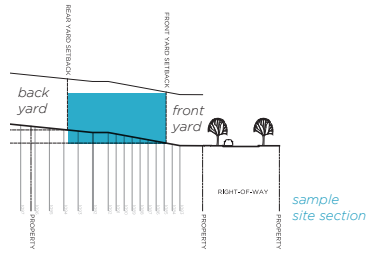


Second Level

scale: 1/8" = 1'-0"

Sample Floor plans

The Blondo Alternate 3 - Partially Enclosed Kitchen w/ Live/Work Option



“Walk-In Basement”

3 Bed/2 Bath Home, Including Extended Family Suite, w/ Office on Narrow Lot (40')

This plan is for homes that are built-into a hill because of site topography.

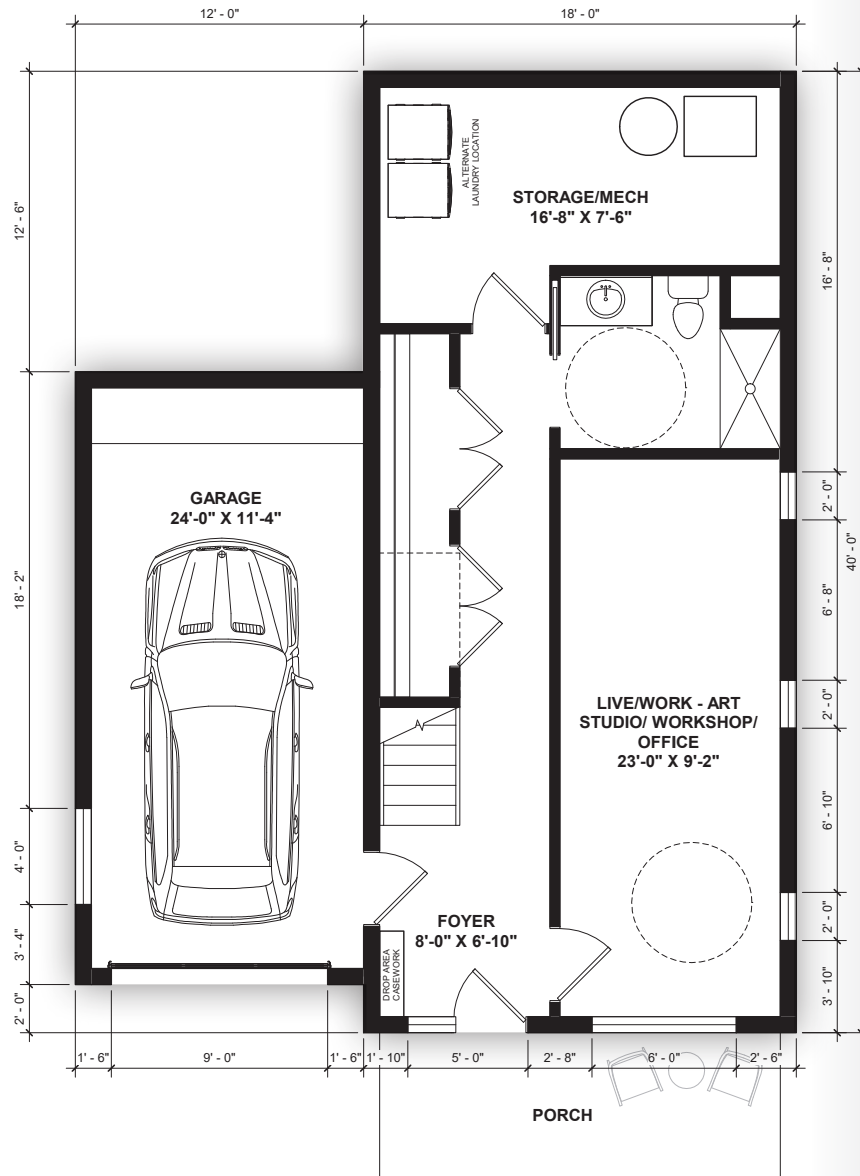
Main Level 720 sf
Upstairs 1,026 sf
Total 1,746 sf

Garage 306 sf

Notes:

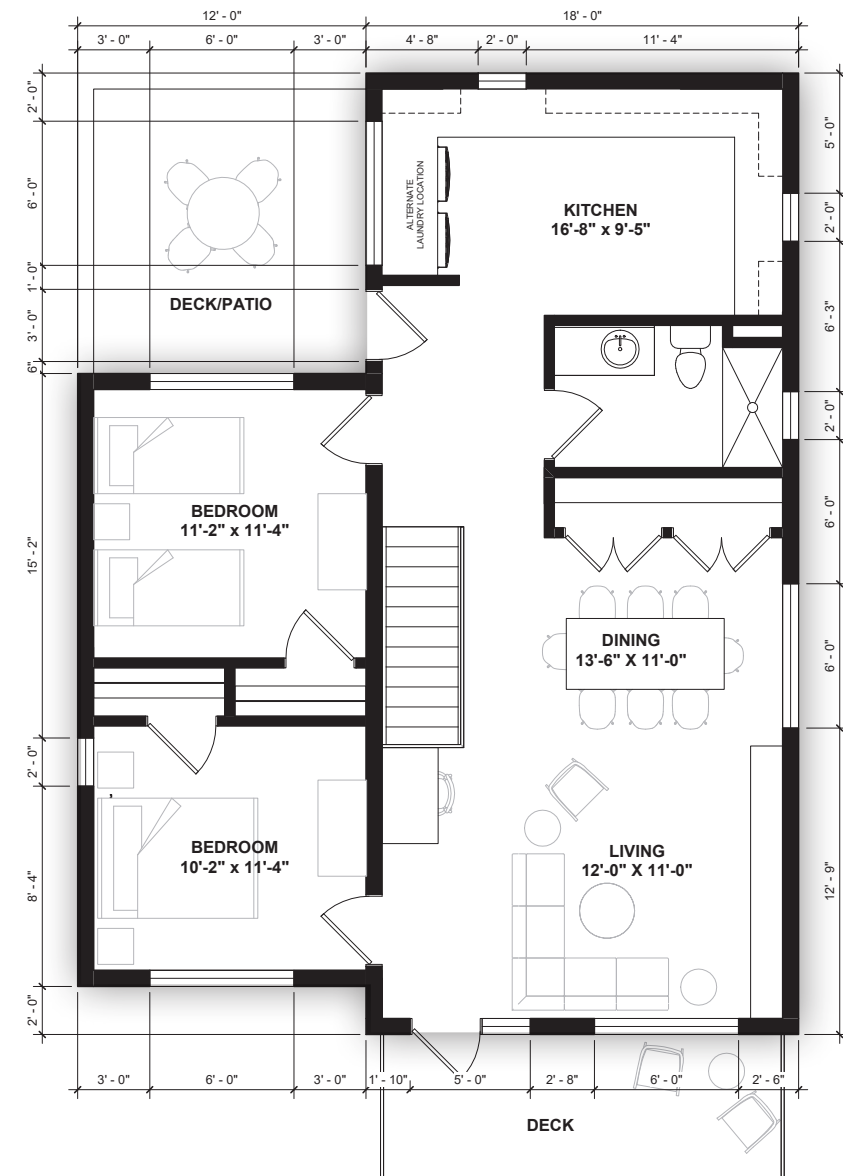
Depending on grade of individual sites, additional lot width may be required to accommodate egress windows from basement bedrooms.

By shifting the bathrooms north, this plan could also accommodate the open kitchen shown in the base Blondo plan on page 104.



First Level

scale: 1/8" = 1'-0"



Second Level

scale: 1/8" = 1'-0"

Interior Materials + Components

Palette Materials Summary

| Design Item | Palette A | Palette B | Palette C | Accessible Considerations |
|---|---|--|--|--|
| General | | | | 36" clear path throughout, must include 1 bedroom & bathroom |
| General Lighting | Thin surface mount pucks at circulation, switched outlets at living room | Thin surface mount pucks, all lights switched and dimmable | Thin surface mount pucks, dimmable & ceiling fans & living spaces and bedrooms, all lights switched and dimmable | |
| Exterior Doors | Flat Panel w/ peek hole | Paneled w/ sidelight | Paneled door w/ glazing & sidelight | |
| Interior Doors | Flat Panel, Hollow Core | 2 Panel, Hollow Core | 4 Panel or Other Decorative Door Style, Solid or Hollow Core | 36" Wide Doors |
| Windows | | | | |
| Appliances | White or Black | Stainless Steel | Stainless Steel | ADA Compliant Appliances |
| Window Coverings | 1" Aluminum Blinds | 2" Wood Blinds (Solid color or wood finish) | Roller Shades w/ Curtains | |
| Flooring @ living & throughout common areas | LVT | Residential Standard Carpet | Wood or Upgraded Residential Carpet | |
| Flooring @ kitchen | LVT | LVT | Ceramic Tile or Wood | |
| Flooring @ bedrooms | LVT | Residential Carpet | Upgraded Residential Carpet or Wood | |
| Flooring @ bathrooms | LVT | Ceramic Tile | Ceramic Tile | |
| Plumbing fixtures @ kitchen | Standard 1 basin undermount stainless steel sink, fixed dual or single chrome faucet | 2 basin undermount stainless steel sink, detachable goose neck faucet, brushed/ satin nickel | 2 basin undermount stainless steel sink w/ disposal, detachable goose neck faucet, brushed/ satin nickel | |
| Kitchen Cabinets | Prefabricated, plywood box, painted white or wood stained finish | Prefabricated, upgraded box, painted white or wood stained finish | Custom wood cabinets, stained or painted finish | Cabinets, Countertops and sink rim to 34"H max. 40" clear between any cabinet, counter & appliance (60" at U-Shaped configuration) |
| Kitchen Counters & Backsplash | Plastic Laminate w/ 4" H backsplash | Solid Surface w/ 4" H backsplash or Ceramic Tile | Quartz or Granite w/ 4" H backsplash or ceramic tile | |
| Island pendant/ Accent kitchen lighting | General Lighting, no pendants | Standard Pendant(s) or specific light over sink | Decorative Pendant(s) or specific light over sink & under cabinet lighting | |
| Bathroom cabinets/ vanity | Prefabricated, plywood box, painted white or wood stained finish | Prefabricated, upgraded box, painted white or wood stained finish | Free standing decorative vanity | Cabinets, Countertops and sink rim to 34"H max. 30" min clear width under sink w/ accessible heights, centered |
| Bathroom countertops/ backsplash | Solid surface w/ 4" backsplash | Solid Surface w/ 4" backsplash | Quartz or granite w/ ceramic tile backsplash | |
| Shower/ Tub | Prefabricated Tub and Shower Surround w/ Curtain Rod | Prefabricated Tub and Shower Surround w/ Stainless & glass door system | Tile Shower walls, Prefabricated tub, Stainless & glass door system | |
| Plumbing Fixtures @ bathroom | Integral solid surface sink, basic faucet, standard toilet | Undermount porcelain sink, upgraded faucet, Standard Toilet | Undermount porcelain sink, Dual flush toilets | Hand wand at shower |
| Toilet Accessories | 1 - 24" towel bar 1 - Towel ring @ sink 1 - Shower Curtain Rod 1 - free standing toilet paper holder 1 - plate glass mirror | 1 - 24" towel bar 1 - Towel ring @ sink 1 - Shower Curtain Rod 1 - standard wall/ cabinet mounted toilet paper holder | 2 - Towel Bars if wall space 1 - Towel ring @ sink 1 - decorative wall/ cabinet mounted toilet paper holder 1 - decorative mirror | Grab Bars @ Toilet & Tub/ Shower |
| Wall Base & Trim | 1x4 Prefinished MDF (limited colors) | 1x4 Painted Hardwood (any color) | 6" H Painted or Stained Hardwood Base | |
| Door & Cabinet Hardware | Standard Brushed/ Satin Nickel finishes, Standard Keyed/ Deadbolt Entry | Standard Brushed/ Satin Nickel finishes, Standard Keyed/ Deadbolt Entry | Standard Brushed/ Satin Nickel finishes, Keyless Entry System | Door handle must be lever type |
| Typical Walls | Painted, 1 color throughout | Painted, 1 main color w/ painted accent walls or rooms as determined by owner | Painted w/ accents or wallcovering accents as determined by owner | |
| Ceiling Finish | Sprayed Texture (white) | Sprayed Texture (white) | Flat Painted Gypsum Board | |
| Closet Storage | White wire shelving & rod | White wire shelving & rod | Solid plastic laminate shelves, wood coat rod | 48" Max Height shelving at accessible bedroom closet |

Universal Design

The contents of this section have been provided by Assistology, LLC, an Omaha-based assistive technology, rehab engineering, accessibility, and universal design consultant.

Why make intentionally flexible design choices?

Creating flexibility and adaptability in how spaces in our homes function benefits a wide range of living situations and needs. No one likes to talk about the "what if's" in life, but at some point it is likely everyone will experience disability - whether temporary when recovering from an injury, or long-term due to injury, illness, or age-related changes to our abilities. When designing a home, talking about the those "what if's" helps ensure you are able to remain in place if changes arise.

Many families deal with multi-generational or extended family living arrangements; such as when an older adult family member or another family member with mobility or sensory related impairments joins your household. Ensuring the space was designed in a way that it can adapt and accommodate their individual needs and allow them to successfully, safely, and independently live is an important consideration.

Remaining in your home if circumstances change that impact your physical abilities is another critical topic. If you, or someone in your household, experiences an illness or injury, can you remain in your home without costly and extensive renovations? Will the design support ongoing changes to abilities as a result of a progressive disease? If your family grows and the additions have access needs, will you be able to remain in your home?

At least 1 in 4 adults are impacted by disability. This means 67 million individuals reported that they are living with a Disability, which is 26% of the adult population - yet less than 2% of the US housing units are accessible - revealing an enormous shortage.

<https://www.census.gov/housing/hvs/index.html>

Key data from [The League](#), an advocacy organization for the inclusion of people with disabilities:

- Fewer than five percent of units are livable for individuals with moderate mobility difficulties.
- Rental units are more likely to be livable than owner-occupied units.
- Wheelchair accessible unit numbers are exceedingly low, far less than one percent. The lack of extra-wide doorways and hallways are the biggest barriers, followed by a lack of accessible bathrooms.
- Units occupied by a Black or Asian householder are less likely to be accessible than those occupied by a White householder. Similarly, foreign-born householders are less likely to occupy accessible units than the native born.
- By education level, householders with bachelor degrees are least likely to reside in accessible units.
- Overall, there are 15 affordable units per 100 disabled households with incomes up to the 10th percentile that meet the level 2 criteria for being livable for individuals with moderate mobility

Universal Design

continued

disabilities. For households at or below the 20th percentile of the income distribution, the number of affordable and accessible units rises to 20 units per 100 disabled households with incomes up to the 20th percentile. Although the number of affordable units rises with income, at the 50th percentile of income, there still are only 25 affordable and accessible units per 100 disabled households with incomes up to the median. The numbers for wheelchair accessible units are far less, with only fractions of one unit available per 100 disabled households, regardless of income.

“Not surprisingly, the report reaches the conclusion that the U.S. housing stock is not well-suited to accommodate people with disabilities or to allow persons to age in place in the housing of their choice. Even in the case of newly constructed homes, it appears that only a minority meets basic accessibility standards. As is becoming more apparent each day, as the U.S. population ages, the demand for accessible homes will only grow.”

Douglas County Housing Authority

DCHA owns and manages elderly and disabled one bedroom apartments in three locations: North Acres, Valley View, and Valley Heights and a set of townhomes that would accommodate families. Other complexes with two- and three-bedroom apartments are in Valley, NE and a house in Waterloo, NE.

<https://www.douglascountyhousing.com/rental.html>

Universal Design Best Practices

General

- Extra wood frame backing in bathrooms at toilets and showers for easy installation of future grab bars and/or shower seat.
- When possible stack closets, pantry or storage spaces to create a potential future elevator shaft.
- Include electrical plans in stair framing for optional lighting on stair treads.
- Window sill height of viewing windows at a height of 36" maximum.

Outdoor pathways

- All pathways should be well lit at either ground level or with overhead fixtures
- Be mindful of shadows
- Pavers or other surface material should be smooth and stable. Pavers as stepping stones with grass, gravel or other medium between are not accessible. Mulch pathways pose a trip hazard and are not accessible with mobility equipment. Crushed gravel/pea stone pathways are not recommended but are better than mulch.
- Pathways should have a consistent slope, goal of less than 5% grade

Entry

- If zero threshold is not possible, two steps, 6" riser height for a height of no more than 12" making it more realistic to add a ramp in the future if needed
- Assess design for ability to easily install a ramp or lift
- When feasible, zero threshold at all entrances, including the garage. When not feasible consider the ability to add a ramp if needed.
- If there are steps from house to garage, extend a first step landing from the threshold and consider installation of railings
- Hallways min 42" wide.

Bathrooms

- No pedestal sinks
- Easily swapped casework to create a roll under sinks
- Counter heights and sink lip at no more than 34"

high

- Curbless shower in primary bedroom bathroom or 1 other main bathroom: 48" x 48" -or- 30" x 60" (with a 34"-36" opening open access on the longer side)

Kitchens

- Choose easily substituted casework to create roll under sink and counter spaces
- Avoid galley kitchen, but if using galley a minimum of 40" wide
- Space between the face of cabinets and another cabinet or walls should be 48" minimum.
- If a 60" turning radius is not possible in a space, ensure a t-shaped turning space is possible.
- 50% of shelving between 18" and 48" from the floor
- Outlet and switch (like garbage disposal) locations should be within easy reach (under sink disposal switch option)

Other

- Consider swapping some high cabinets for clerestory windows or other feature as they often serve no functional purpose in day to day living
- Adjustable shelving - vertically and pull out (e.g., shelf genie or other roll out shelves, or vertical pull down shelves for upper cabinets)
- Appliances
 - Top loading dishwasher
 - Raised dishwasher, washer and dryer
 - Undercounter microwave
 - Side opening oven
 - Separate oven and range top
- When placing appliances in a kitchen think about function of someone using a wheelchair or other equipment and simultaneously being able to use multiple features (i.e. emptying the dishwasher into drawers and cabinets, usually impeded when an island is present).

Universal Design Best Practices *continued*

Casework

- Designed to be easily omitted or swapped for removable convertible cabinets (e.g., Rynone convertible vanity cabinet)
- 21" reach in depth is ideal, 24" max
- 50% of shelving and storage at or below 48"
- Ability to adjust appliance location such as raising a dishwasher or installing an under counter microwave
- Under sink clearance of 29" possible with a reduced bowl depth
- Sink design can support a 6" deep kitchen sink bowl at resident choice

Bedroom

- Ability to show a 60" (5') turning radius somewhere near bedside.
- U-shaped handles vs pulls on drawers and cabinets
- Lever handles on all doors

Electrical - indoor and outdoor lighting (paths, closets, stairs)

- Adjustable/dimmable lighting in as many areas as possible to accommodate a range of vision needs
- Outdoor lights wired to be on timers
- Include lighting in all non-reach-in storage (walk-in pantry and closets)
- Electrical planned in stair framing for stair riser lighting option
- Light switches (switch height) 42" measured from the ground.
- Outlets no less than 18" from the floor measured to the bottom edge of the cover plate.

Gardens

- Consider locations for raised garden beds on or near a patio
- Grades that allow a hard surface path access to garden area

Doors (swing, pocket, barn)

- Interior door: Width 32" min, 34-36" when possible (36" is ideal)
- Exterior door: width 36" min
- Pocket doors can help preserve clear floor space in smaller spaces like bathrooms and laundry areas
- Clear floor space: 18" min on pull side at latch jamb
- Interior pocket doors: when fully open, the door should extend 2" minimum outside door jamb and be equipped with open-loop handles for easy gripping.

Hardware

- Choose grab bars that double as towel racks and shelving in shower to increase aesthetics and function, as well as meet current or future accessibility needs
- Swing away hinges can create extra clearance in doorways that could not be created as wide as recommended and support potential future needs (and moving of furniture etc)
- Rocker style light switches
- Light switch and outlet combinations make outlet access more accessible and safe (no bending) for a wide range of users



Extended first step landing



Drop zone



Laundry with roll under sink, elevated appliances, and pull out storage and drying racks

Universal Design Best Practices *continued*



Pull out accessible storage and vanity examples



Accessible bathrooms and storage



Accessible kitchen concepts

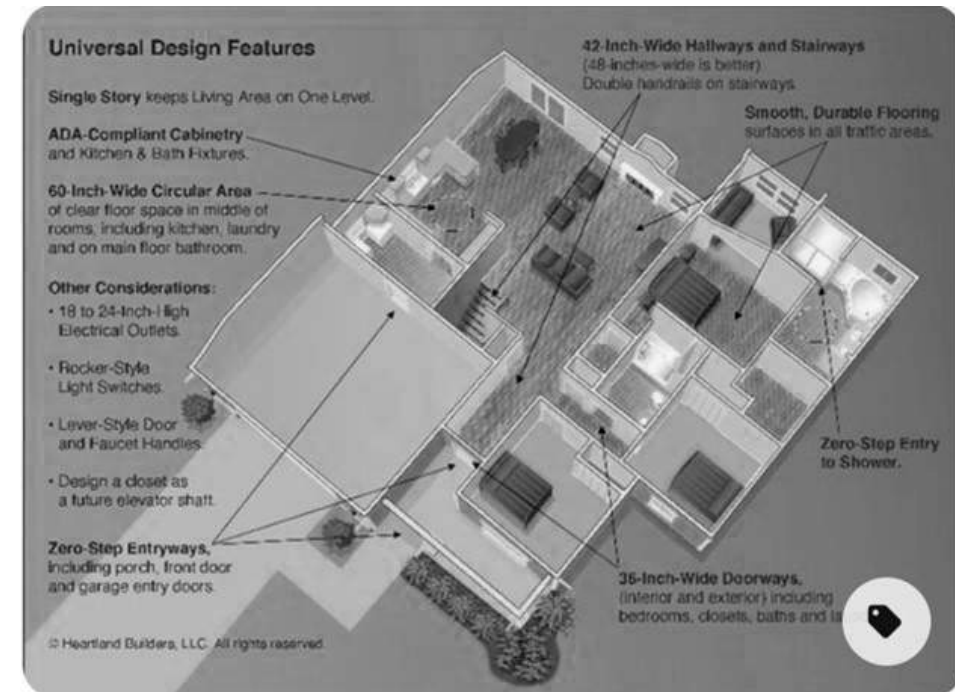
Universal Design Best Practices *continued*



Accessible entry concept

Resources:

- Universal Design Project: <https://universaldesign.org/>
- Apartment Therapy: Here's How a Can of Paint Can Help Make Your Home More Accessible to All
<https://resources.wellcertified.com/articles/the-iwbi-special-report-chapter-series-affordable-housing-is-fundamental-to-health-equity/>
- Good Fit Poor Fit: 064: Forever Homes
- 140 million housing units: <https://www.census.gov/housing/hvs/index.html>
- 67 million people w/ disabilities: <https://www.cdc.gov/ncbddd/disabilityandhealth/infographic-disability-impacts-all.html>
(number has been updated from 61 to 67 for 26% of current census)
- < 200k / 0.15% of homes universally accessible: <https://www.huduser.gov/portal/publications/mdrt/accessibility-america-housingStock.html>
(see p.2 for a summary table — 7th page of the PDF)
- Homeguides.sfgate.com



Our analysis finds that almost one third of housing is potentially modifiable, but we estimate that just 0.15% of housing is currently wheelchair accessible. These rates are consistently higher for housing that is occupied by a person with a disability.

| Accessibility level | Prevalence |
|---|--|
| Level 1: Potentially Modifiable. The home has some essential structure features for accessibility, but would not be accessible without further modifications. This includes stepless entry from the exterior, bathroom and bedroom on the entry level or presence of elevator in the unit. | 33.3% of all housing units 44.2% of housing units with a resident wheelchair user |
| Level 2: Livable for individuals with moderate mobility difficulties. A person with moderate mobility difficulties can live in the home. This includes all the elements in level 1 plus no steps between rooms or rails/grab bars along all steps and an accessible bathroom with grab bars. | 3.8% of all housing units 12.4% of housing units with a resident wheelchair user |
| Level 3: Wheelchair accessible. The home has a minimum level of accessibility so that a wheelchair user can live in the home and prepare his or her own meals. This includes all the elements in levels 1 and 2, but removes the possibility of any steps between rooms, even if grab bars are present, and adds door handles and sink handles/levers | 0.15% of all housing units 0.73% of housing units with a resident wheelchair user |

Envelope + Energy Best Practices

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| Appendix A - Reference Information | 142 |

Acronym List

- AC - air conditioning
- AHU - air handling unit
- ASHRAE - American Society of Heating Refrigeration and Air-Conditioning Engineers
- BTU - British thermal units
- c.i. - continuous insulation
- CW - cold water
- CFM - cubic feet per minute (air flow)
- DHW - domestic hot water
- DX - direct expansion
- EA - exhaust air
- EPA - Environmental Protection Agency
- EUI - energy utilization index
- GPC - gallons per cycle
- GPF - gallons per flush
- GPM - gallons per minute
- GSF - gross square feet
- HVAC - heating ventilating and AC
- HWC - hot water circulator
- IAQ - indoor air quality
- IECC - international energy conservation code
- IEQ - indoor environmental quality
- KBTU - one thousand BTU
- LPD - lighting power density (W/sf)
- MEI - morrissey engineering, inc.
- MERV - minimum efficiency reporting value
- OA - outside air
- o.c. - on center
- SA - supply air
- SHGC - solar heat gain coefficient
- Tdb - dry bulb temperature
- Twb - wet bulb temperature
- TAB - testing, adjusting and balancing
- TVOC - total volatile organic compounds
- UV-C - ultraviolet shortwave light
- VAV - variable air volume
- WF - water factor
- WFA - window to floor area (ratio)

Section 1.0 - Executive Summary

The information contained herein is intended to be conceptual in nature with rules of thumb and examples applicable for single-family homeowners and small developers.

Section 2.0 - Best Practice Considerations

| | |
|---------------------------------|---|
| Project Address | 2112 N 30th St. Omaha, NE 68111 |
| Climate Zone | 5A |
| Hygro-Thermal Region | Cold ($\geq 5,400$ and $\leq 9,000$ heating degree days @ 65°F base) |
| Rain Exposure Zone | Moderate (20-40"). Drainage Plane / Drainage Space |
| Interior Climate Classification | Single Family Residential, 3 Bedrooms |
| Square Footage | 1,800 GSF |
| Window-to-Floor Area (WFA) | 15.7% (excluding doors) |
| Energy Code | 2018 IECC (residential) |
| Utilities | Electric - OPPD, \$0.10 / kWh Gas - MUD, \$0.90 / therm |

Best practices below consider the following:

- lower ongoing maintenance costs when repairs or replacements are needed
- lower utility costs for homeowners, assuming average escalation of 5% per year
- meeting current energy code for Omaha (2018 IECC + amendments)
- prioritization of health, comfort, and conservation for people and planet
- reducing the builder's warranty and callback expenses

Buildings must be suited to their local environment. Historically we have understood that seismic activity, wind and snow loads, soil conditions, frost depth, and rain all must be addressed through design and construction. However, variances in temperature, humidity, and interior climatic conditions should also play an equally important role in selection of building envelope and mechanical systems. The images below show the prototype home with a 'plan north' orientation and associated self-shading on the summer and winter solstice.

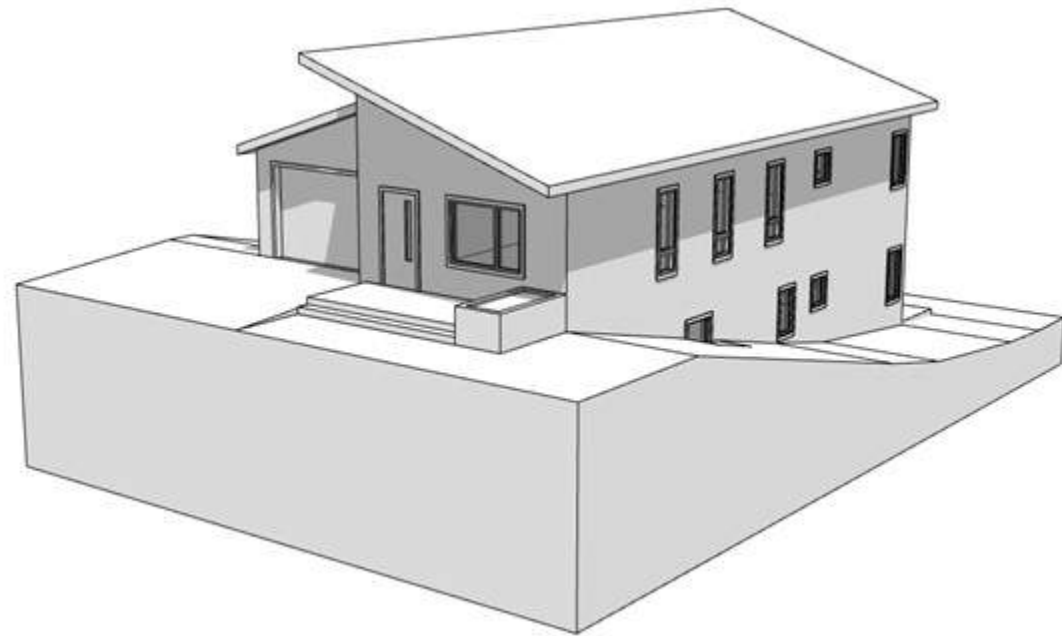


Figure 1 - Self-shading at Summer Solstice (6/21 @ noon) - Southeast Elevation

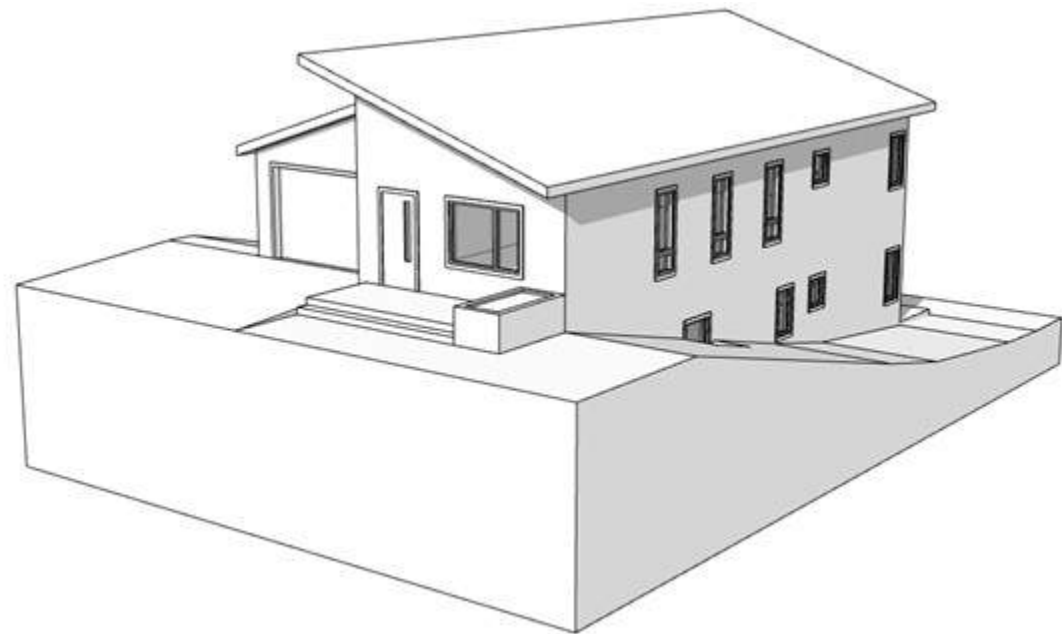


Figure 2 - Self-shading at Winter Solstice (12/21 @ noon) - Southeast Elevation

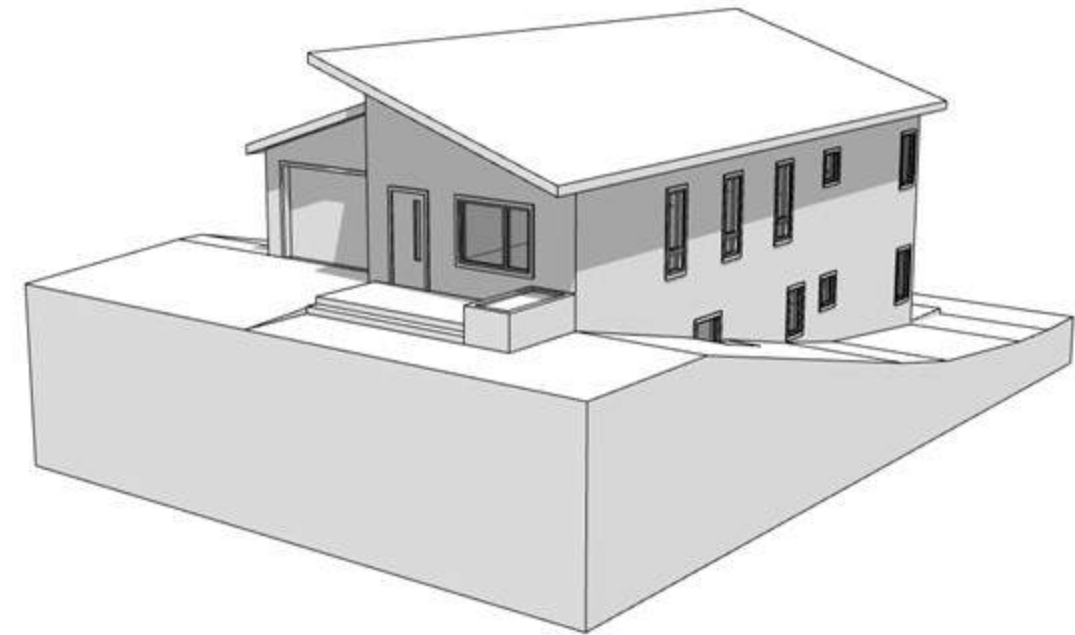


Figure 1 - Self-shading at Summer Solstice (6/21 @ noon) - Southeast Elevation

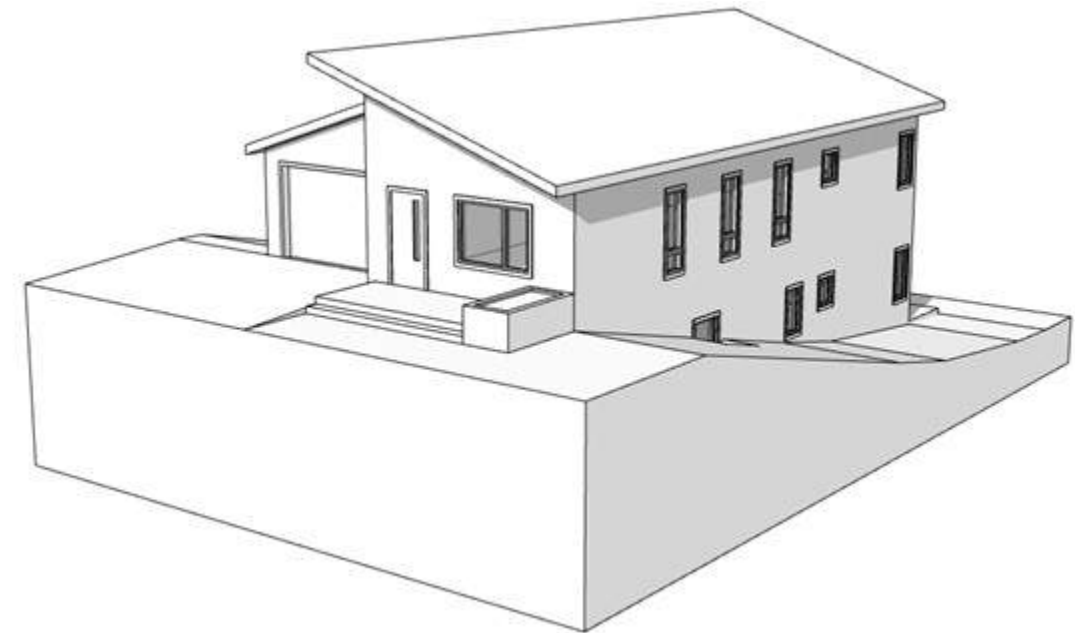


Figure 2 - Self-shading at Winter Solstice (12/21 @ noon) - Southeast Elevation

2.1 - Envelope Best Practices

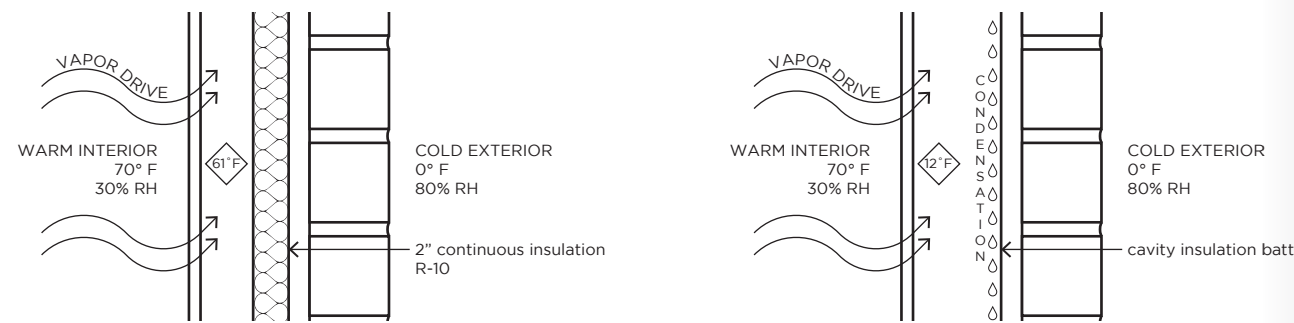
Reducing warranty and callback expenses results in an immediate payback for the contractor and ongoing value to the owner. But this often involves increasing initial construction cost to spend time upgrading materials or equipment to increase the energy efficiency and performance of a home. These savings are passed through to the owner, so do incur some additional upfront costs by the contractor. There can, however, be some trade-offs that should be captured in costing. If, for example, construction costs increase due to improvements in the building envelope allow mechanical equipment to be downsized, initial costs overall could be offset by reduced costs associated with downsized HVAC. This requires attention to detail and 'right-sizing' equipment to actual design conditions. This type of attention also results in a healthier home that is safer, more comfortable, durable, and affordable.

For our climate zone, IECC 2018 calls out the following required insulation and fenestration requirements by component (Tables R402.1.2 and R402.1.4):

- Fenestration U-factor (0.30 max), SHGC (NR)
- Skylight U-factor (0.55 max), SHGC (NR)
- Ceiling / Roof R-value (49)
 - equivalent U-factor = 0.026 max / overall R-value (34.48)
- Wood Frame Wall R-value (20 or 13+5 c.i.)
 - equivalent U-factor = 0.060 max / overall R-value (16.67)
- Mass Wall R-value (13, exterior) or (17, interior)
 - equivalent U-factor = 0.082 max / overall R-value (12.19)
- Floor R-value (30)
 - equivalent U-factor = 0.033 max / overall R-value (30.30)
- Basement Wall R-value (15 c.i.) or (19, cavity interior)
 - equivalent U-factor = 0.050 max / overall R-value (20)
- Slab R-value & depth (10) for 2 feet of slab edge
- Crawl Space Wall R-value (15 c.i.) or (19, cavity interior)
 - equivalent U-factor = 0.055 max / overall R-value (18.18)

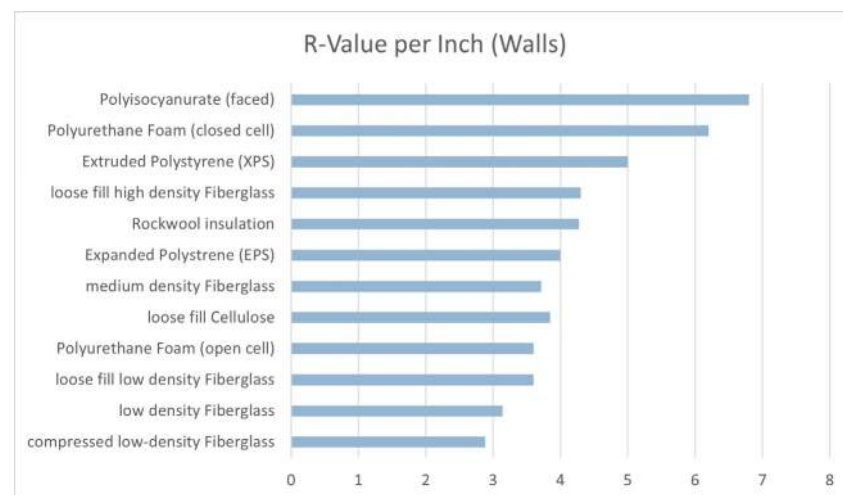
2.1.a - Insulation

Consider continuous exterior insulation: Cavity batt insulation in traditional wall construction is interrupted by framing members and can result in colder than anticipated conditions inside the wall assembly. Depending on climatic conditions, wall construction, and vapor drive from interior on a cold day, there is even potential for condensation.



This risk can be mitigated in large part with the use of continuous insulation with a product like Zip R-6 that includes insulation adhered to cladding substrate, mounted on the outside of the stud assembly. Or insulated siding which can also provide a continuous R-value at the exterior.

Insulation performance: Common insulating product performance is shown in the table below. Confirm specific R-values of the insulation products on the product itself, the packaging, or in documentation provided by the installer or supplier. Note that compressed batt insulation does not perform at its listed R-value. Nor does batt insulation which is interrupted by framing (R-20 batt ≠ R-20 wall assembly).



2.1.b - Wall Assembly Performance

Insulation: The energy code calls out R-20 wall cavity batt insulation or R-13 cavity insulation + R-5 continuous insulation. If multiple insulation materials, blown insulations, or insulated siding are used, however, the wall R-value (or equivalent U-factor) should be calculated as shown in the example below, using the assembly table shown here, in which the individual R-values for cavity and framing (studs, plates, and headers) are added to get a “sum of thermal resistance” for each heat flow pathways through the wall assembly. For an assembly with 16-in o.c. spacing, the weighting factors of 75% cavity, 21% studs / plates, and 4% headers are used (whereas 24-in o.c. spacing utilizes weighting factors of 78%, 18%, and 4%, respectively).

| WALL COMPONENT | CAVITY | STUDS, PLATES | HEADERS |
|---------------------------|---------|---------------|---------|
| | R-value | R-value | R-value |
| Outside air film | 0.25 | 0.25 | 0.25 |
| Plywood siding | 0.59 | 0.59 | 0.59 |
| Continuous insulation | 5 | 5 | 5 |
| Plywood sheathing | 0.83 | 0.83 | 0.83 |
| Wood studs | — | 4.38 | 4.38 |
| Cavity insulation | 13 | — | — |
| 1/2" Gypsum board | 0.45 | 0.45 | 0.45 |
| Inside air film | 0.68 | 0.68 | 0.68 |
| Sum of thermal resistance | 20.8 | 12.18 | 12.18 |

For SI: 1 inch = 25.4 mm.

**Commentary Figure R402.1.4(1)
EXAMPLE OF U-FACTOR
CALCULATION IN TABLE R402.1.4**

Finally, because the U-factor is 1/R-value the calculation is:

$$U = \frac{0.75}{20.8} + \frac{0.21}{12.18} + \frac{0.04}{12.18} = 0.057$$

Exterior Sheathing: The exterior sheathing is one of the most susceptible locations in the building envelope assembly for moisture accumulation. The selection of the exterior sheathing defines not only the water vapor permeance of the component, but the amount of water that can be safely held by this component.

Behind the Cladding: An air gap placed behind a cladding allows the cavity to drain/ventilate and allow moisture to escape. A “ventilated” air gap is open at both the bottom and top, while a “drained” air gap is open at just the bottom. Research has shown that a ventilated air gap has more than 3x the air flow through the space compared to a drained cavity. For any absorptive cladding, a ventilated air gap is highly recommended for reducing moisture flow created by solar driven rain.

Weather Resistive Barrier (WRB): Though the IRC calls for No. 15 asphalt felt (Type 1 as defined by ASTM D226, meaning the felt must weigh 11.5 # / ft²), other substitutions are allowed. In most cases, WRBs are not ABs (except for Zip System sheathing and liquid-applied WRBs). There are many types of water-resistive barriers (WRB) and air barriers. According to tests performed by the International Code Council Evaluation Service (ICC-ES), several products have been approved as substitutes for No. 15 asphalt felt, including Grade D building paper, plastic housewraps like Tyvek and Typar, liquid-applied WRBs like StoGuard or Tyvek Fluid Applied WB, and certain building assemblies that include rigid foam.

As a general guideline, an impermeable fully-adhered sheet membrane has a water vapor permeance < 1.0 perm. Some sheet manufacturers report their WRBs as “vapor permeable”. In these instances, select the permeable fully-adhered sheet membrane. Liquid applied coatings used as a WRB/AB typically have moderate permeances, “between 1.0 and 10 perms”. Building paper also falls within this range of permeance. House wraps are very permeable compared to the other products available and typically have permeances > 50 perms. Asphalt felt has a permeance of only 5 when dry, but 60 perms when wet. This advantage allows the felt to soak up liquid water (due to flashing leak or condensation on the surface) and gradually dry to the exterior. It also is better capable of sealing around fastener holes than housewrap.

Vapor Retarders: Class I or II vapor retarders are required on the interior side of frame walls in our climate zone. Vapor retarders are installed on the interior of the building assembly to allow drying to the exterior, in combination with permeable sheathings and WRBs. A vapor retarder is not required for basement walls or on any portion of the wall that is below ground or on walls made of materials that can't be damaged by moisture or by freezing.

- “Class I” (very low permeability) › rated at 0.1 perms or less. Includes sheet polyethylene (visqueen) and non-perforated aluminum foil (FSK).
- “Class II” (low permeability) › rated greater than 0.1 and less than or equal to 1.0 perms. Examples are kraft paper (like on batt insulation) or low vapor permeance paints.
- “Class III” (medium permeability) › rated greater than 1.0 perms and less than or equal to 10 perms. Latex or enamel paint are examples.

Pay attention to vapor permeance of the WRB to avoid trapping moisture and allow drying. In our climate zone, where hot humid summers also require air conditioning, use of a “smart vapor retarder” like MemBrain (CertainTeed), Intello Plus, or DB+ by Pro Clima.

Table 1 - Vapor Retarder Materials and Perm Ratings

| Vapor Retarder Material | Perm Rating |
|---|-------------|
| Insulation Facing, Kraft Paper | 1.0 |
| 1/4" Plywood (Douglas Fir, Exterior Glue) | 0.7 |
| Insulation Facing, Foil Kraft, Laminate | 0.5 |
| Vapor Retarder Latex Paint .0031" Thick | 0.45 |
| .002" Polyethylene | 0.16 |
| .004" Polyethylene | 0.08 |
| .0006" Polyethylene | 0.06 |
| Aluminum Foil .00035" Thick | 0.05 |
| Aluminum Foil .001" Thick | 0.01 |

Table 2 - Not Vapor Retarder Materials and Perm Ratings

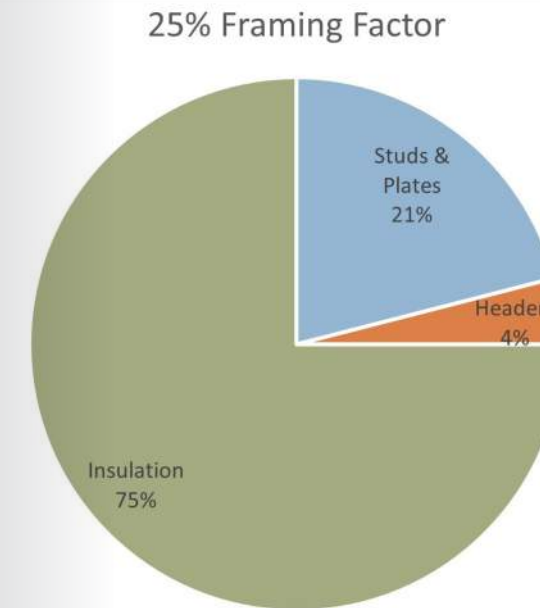
| Not Vapor Retarder Material | Perm Rating |
|---|-------------|
| 3/8" Gypsum Wall Board (Plain) | 50 |
| 4" Unfaced Mineral Wool | 30 |
| Typical Latex Paint - 0.002" Thickness | 5.5 to 8.6 |
| 4.4 LB/100FTS Asphalt Saturated Sheathing Paper | 3.3 |
| 1/4" Plywood (Douglas Fir, Interior Glue) | 1.9 |

2.1.c - Advanced Framing

When using wood framing, consider utilizing stud spacing on 24-inch centers rather than 16-in. Coupled with single plates, stack framing, two stud corners, and the minimization of cripples, it is possible to frame with 2x6's less expensively than 2x4's. The volume of lumber is about the same, but there are around 30% fewer pieces, so the building goes together faster (labor savings) and the wall is thicker to accommodate more insulation.

The term ‘framing factor’ is used to express, as a percentage, the total amount of solid exterior wall area occupied by framing members (including headers). The framing factor of a standard residential wall typically consists of 25%, with headers accounting for around 4% of this total. An understanding of wall framing factors and insulated wall headers is important to determine the most cost-effective wall assembly options. By reducing framing factor, the builder is able to increase the amount of insulation and achieve greater overall energy performance at lower cost.

A framing factor of 25%, for example, would be represented graphically as shown at left.



Advanced framing: The framing factor for a solid wall assembly can be reduced by adopting advanced framing techniques such as:

Wall stud spacing – instead of standard 16" o.c. spacing, increase stud spacing to as much as 24" o.c. for greater cavity insulation space.

Corner framing – standard wall corners are often framed in a manner that results in enclosed corner cavities that are difficult or impossible to insulate effectively. Advanced corner framing techniques allow for insulation to extend into corners.

Insulated interior-exterior wall intersections – advanced framing uses flat-wise horizontal blocking or other means to provide a means for drywall attachment where interior walls intersect with exterior walls. This provides room for insulation at these intersections.

More information on common advanced framing techniques is detailed in APA's "Advanced Framing Construction Guide, Form M400" and at <https://www.apawood.org/advanced-framing>

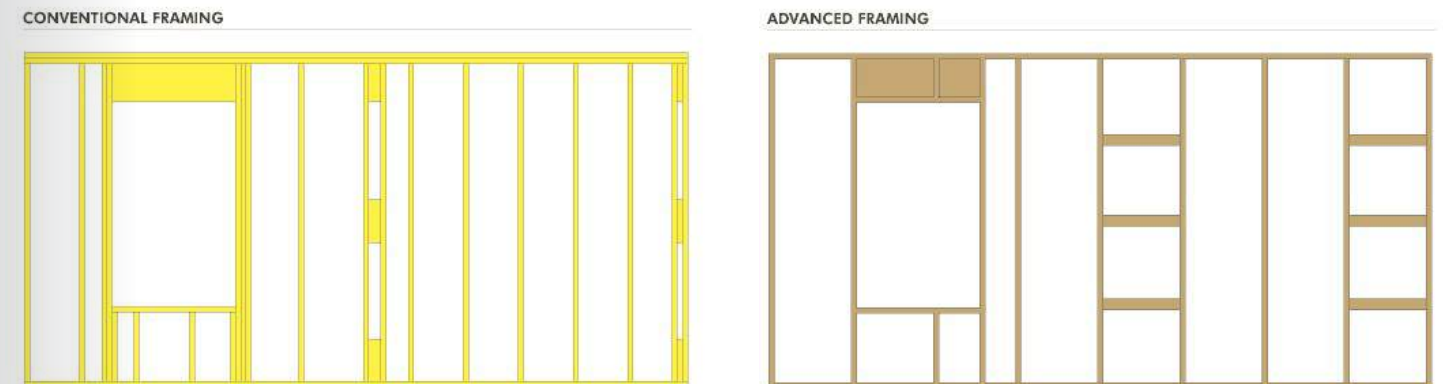


Table 3 - Framing Factor Examples

| Size and Spacing | Headers & Double Top Plates | Framing Factor |
|------------------|-----------------------------|----------------|
| 2x4 @ 16" O.C. | Conventional | 25% |
| 2x4 @ 16" O.C. | Insulated | 22% |
| 2x4 @ 16" O.C. | Insulated | 22% |
| 2x6 @ 24" O.C. | Conventional | 20% |
| 2x6 @ 24" O.C. | Insulated | 18% |

2.1.d - Air Leakage

Air changes per hour (ACH) is a measure of the air leakage of a home, calculated using a blower door to create a pressure difference of 50 pascals (a unit of pressure) between inside the home and outside. A building's ACH50 (air changes per hour at that pressure) tells us how leaky the building envelope is – the lower the ACH50, the tighter the building air sealing. The energy code calls for ≤ 3 ACH50, or 3 air changes per hour at 50 pascals of pressure, in our climate zone. A leaky building might be 15 ACH50, while a high-performance building is typically 1 ACH50 or less.

A continuous air barrier shall be installed in the building envelope, in line with the exterior thermal envelope, if possible. Breaks or joints in the air barrier shall be sealed.

Blower door testing is not required in Omaha, but at an approximate cost of \$200 is of high value to help ensure homeowner satisfaction. It should be completed after all penetrations are complete in the building envelope.

Ceiling / Attic: The air barrier in any dropped ceiling or soffit should be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop-down stairs or knee wall doors to unconditioned attic spaces shall be sealed. The insulation in any dropped ceiling/soffit should be aligned with the air barrier.

Walls: The junction of the foundation and sill plate as well as the junction of the top plate and top of exterior walls and knee walls should be sealed. Cavities within corners and headers of frame walls should be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls should be installed in substantial contact and continuous alignment with the air barrier.

Windows, skylights and doors: The space between framing and skylights, and the jambs of windows and doors, should be sealed. Windows, skylights and sliding glass doors should have an air infiltration rate of not greater than 0.3 cfm per square foot, and for swinging doors, not greater than 0.5 cfm per square foot, when tested in accordance with NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440.

Rim joists: Rim joists should include the air barrier. Rim joists should be insulated.

Floors, including cantilevered floors and floors above garages: The air barrier shall be installed at any exposed edge of insulation. Floor framing cavity insulation should be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation should be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing; and should extend from the bottom to the top of all perimeter floor framing members.

Crawl space walls: Exposed earth in unvented crawl spaces should be covered with a Class I vapor retarder with overlapping joints taped. Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.

Shafts & penetrations: Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space should be sealed.

Narrow cavities: Batts to be installed in narrow cavities should be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.

Garage separation: Air sealing should be provided between the garage and conditioned spaces.

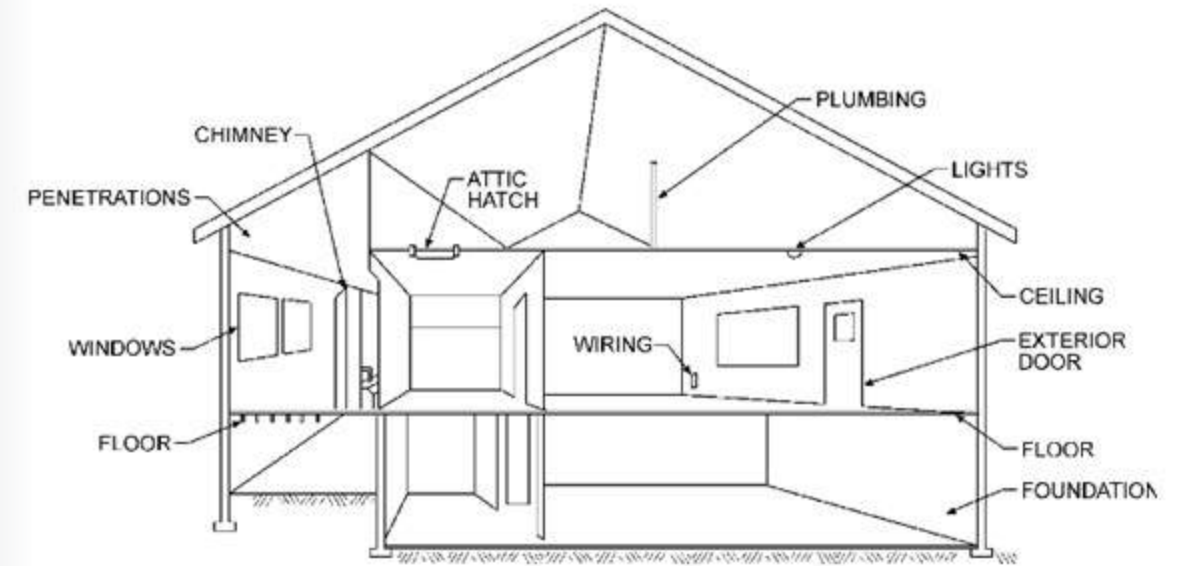
Recessed lighting: Recessed light fixtures installed in the building thermal envelope should be sealed to the finished surface. Recessed light fixtures installed in the building thermal envelope shall be airtight and IC rated.

Plumbing and wiring: In exterior walls, batt insulation should be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, should extend behind piping and wiring.

Shower/tub on exterior wall: The air barrier installed at exterior walls adjacent to showers and tubs should separate the wall from the shower or tub. Exterior walls adjacent to showers and tubs should be insulated.

Electrical/phone box on exterior walls: The air barrier should be installed behind electrical and communication boxes. Alternatively, air-sealed boxes should be installed.

HVAC register boots: HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.



**Commentary Figure R402.4
TYPICAL SOURCES OF AIR LEAKAGE IN THE HOME**

The wall assemblies in the table below should demonstrate good moisture durability, drying capacity, and thermal performance in our climate zone, assuming fiber cement siding, and air tightness of 3 ACH50.

2.1.e - Window Performance

Considering windows is critical for long term operation cost in a home. Less windows and the best possible performing windows make a big difference in energy cost and comfort inside the home (both for summer and winter). For comparison, the overall R-value (insulating capacity) of a typical residential wall is R-20 while the equivalent R-value of a window is R-3.3 (approximately 6x less efficient). In our climate zone, window U-factor should be ≤ 0.26 and SHGC could ideally be high as possible if windows are fully shaded in summer (see Section 2.1.h).

2.1.f - Window Quantity

There is a direct correlation between the quantity of windows and comfort / energy use in a home. North-facing windows provide excellent daylight without glare, and should be provided at around 3-5% of the floor area. Minimize or eliminate west-facing glazing to reduce summer and fall afternoon heat gain.

South-facing glazing area should be at least 50% greater than the sum of the glazing area on the east and west-facing walls for passive solar gains.

In our climate zone, total window quantity should not exceed a WFA of 15%, which means in this case for a 1,800 ft² home, area of windows should not exceed 270 ft².

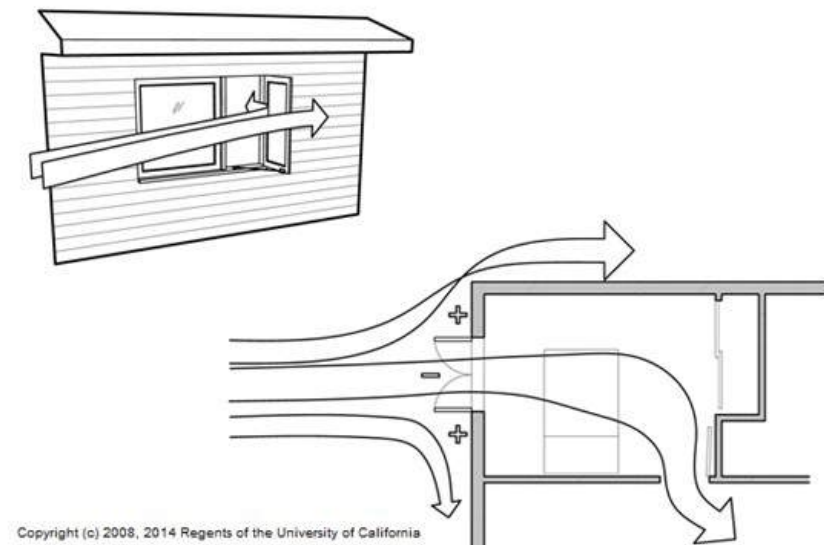


Table 4 - Wall Examples for Climate Zone 5A

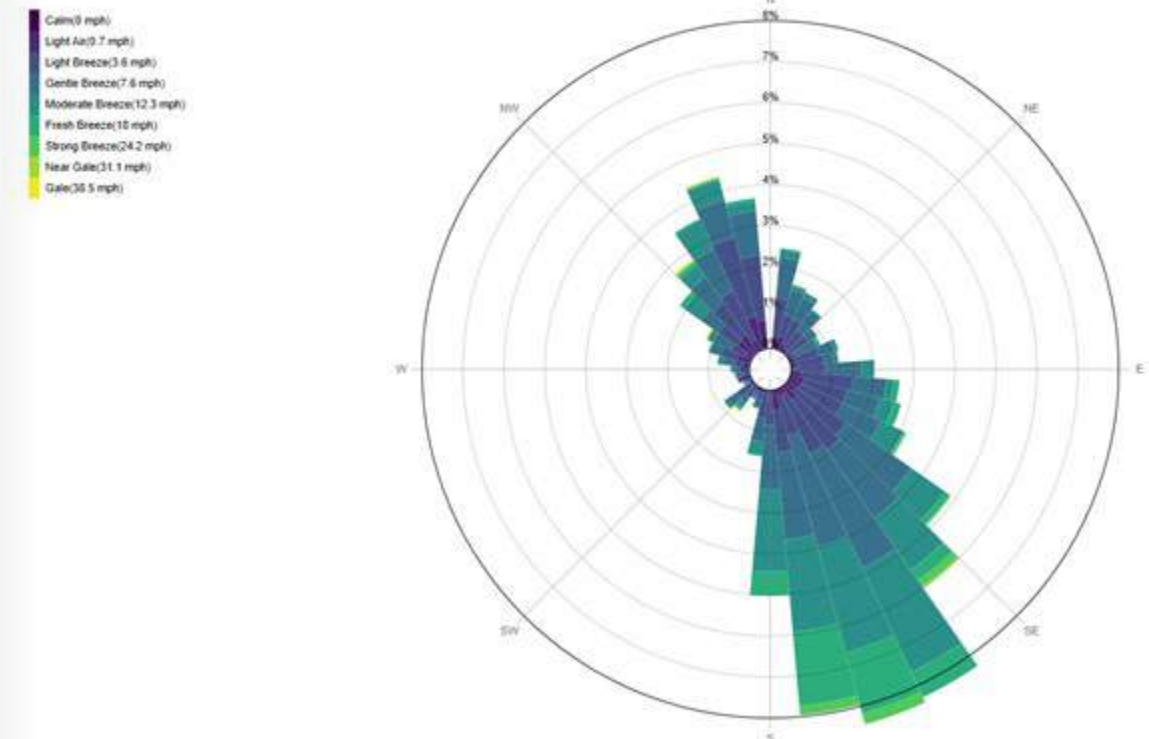
| Structure | | Insulation | | Water Control | Interior Control | Performance | | | |
|-----------------------------|---------------------------|---|--|-------------------------------------|--|----------------|---|--------------------|---------------------|
| Exterior Sheathing | Wall Structure | Continuous Insulation | Cavity Insulation | Behind Cladding | Weather Resistive Barrier (WRB) | Interior Paint | Vapor Retarder | Insulation R-Value | Total Wall U-factor |
| Plywood, OSB, or Fiberboard | 2x4 @ 16" O.C. wood frame | None | Closed-cell spray foam (entire cavity) | Drained and/or Ventilated Air Space | Housewrap, Building Paper, Permeable Liquid-Applied Coating, or Permeable Fully-Adhered Membrane | Latex | Polyethylene Sheet, Kraft Paper, Al Foil, or Smart Vapor Retarder | R-21 | 0.070 |
| Plywood, OSB, or Fiberboard | 2x4 @ 16" O.C. wood frame | 1" Extruded Polystyrene (XPS) or Polyisocyanurate foam | Medium performance fiberglass (R-13) | Drained and/or Ventilated Air Space | Housewrap, Building Paper, or Permeable Fully-Adhered Membrane | Latex | Polyethylene Sheet, Kraft Paper, Al Foil, or Smart Vapor Retarder | R-13 + 5.6 | 0.057 |
| Plywood, OSB, or Fiberboard | 2x4 @ 16" O.C. wood frame | 1" Extruded Polystyrene (XPS) or Polyisocyanurate foam | High performance fiberglass (R-15) | Drained and/or Ventilated Air Space | Housewrap, Building Paper, or Permeable Fully-Adhered Membrane | Latex | Polyethylene Sheet, Kraft Paper, Al Foil, or Smart Vapor Retarder | R-15 + R-5.6 | 0.055 |
| Plywood, OSB, or Fiberboard | 2x4 @ 16" O.C. wood frame | 1/2" Expanded Polystyrene (EPS), Extruded Polystyrene (XPS), or Polyisocyanurate foam | Medium performance fiberglass (R-21) | Drained and/or Ventilated Air Space | Housewrap, Building Paper, or Permeable Fully-Adhered Membrane | Latex | Polyethylene Sheet, Kraft Paper, Al Foil, or Smart Vapor Retarder | R-21 + 2.5 | 0.049 |
| Plywood, OSB, or Fiberboard | 2x4 @ 16" O.C. wood frame | 1/2" Expanded Polystyrene (EPS), Extruded Polystyrene (XPS), or Polyisocyanurate foam | None | Drained and/or Ventilated Air Space | Housewrap or Building Paper | Latex | Polyethylene Sheet, Kraft Paper, Al Foil, or Smart Vapor Retarder | R-15.2 + 5.6 | 0.042 |

2.1.g - Orientation and Layout

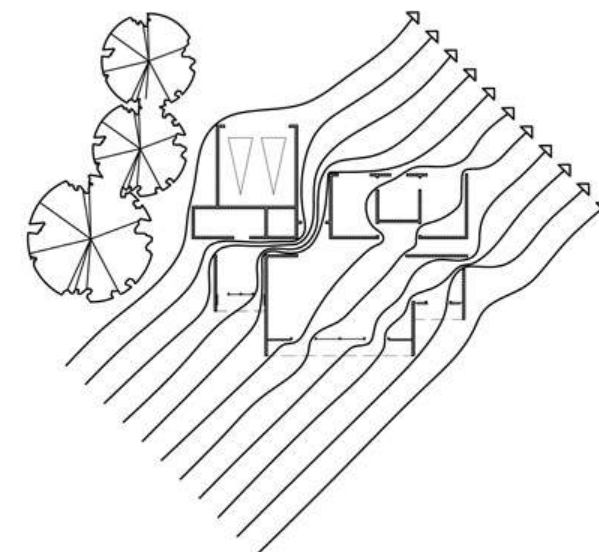
Good natural ventilation can reduce or eliminate the need for air conditioning in warm weather, if windows are well-shaded (see below) and oriented to prevailing breezes. Consider swing-out windows, exterior wing-walls, or strategic plantings to capture and redirect breezes by up to 45 degrees. Refer to wind rose below, which shows that South-East and North-West orientations are favorable.

Rule of thumb to maximize for passive solar is orienting the home so the east-west axis is within 15 degrees of due east-west.

Jun 1 - Aug 31 | Whole Day | + Calm 0 mph | -5 - 100°F
Total 2200 hrs | Medium Speed 8.1 mph
OmahaEppleyAFIntAP

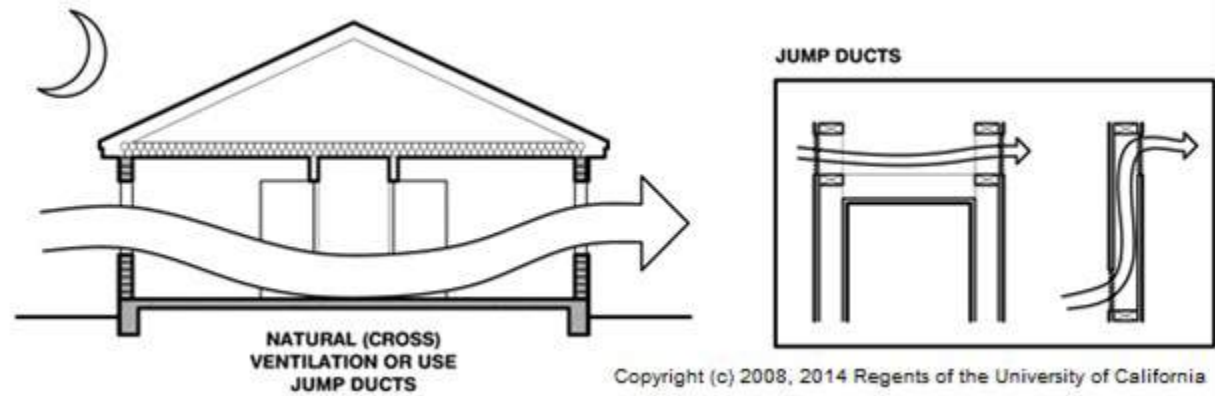


Maintaining a long, narrow floor plan can help maximize cross ventilation potential. Door and window openings should be located on opposite sides of the home with larger openings facing up-wind (the direction from which the wind is blowing), if possible. Using the wind rose above (June - August) this would indicate that a South-East orientation would want to have larger openings with open flow through to the North-West direction.



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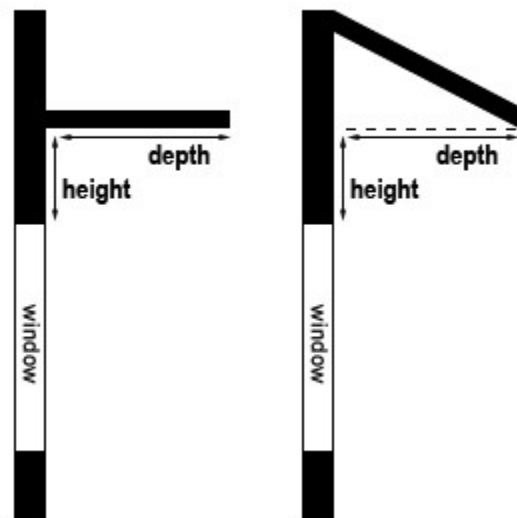
Use open plan interiors: To promote natural cross-ventilation. Consider louvered doors, or for more sound privacy, jump ducts within walls.



2.1.h - Overhangs

Solar heat gain through windows in winter is favorable, since Omaha is located in a heating-dominant climate (meaning, most annual energy use is from heating rather than cooling). However, direct solar heat gain in summer can result in large cooling requirements. For this reason, it is important to shade at least 90% of the south-facing windows, ideally, from the outside with permanent overhangs at solar noon on summer solstice and unshaded at noon on the winter solstice. Approximate sizing for our location is as follows:

- Window Height @ 3 feet › Shade Depth of 1'-11", Height of 11"
- Window Height @ 4 feet › Shade Depth of 2'-6", Height of 1'-3"
- Window Height @ 5 feet › Shade Depth of 3'-2", Height of 1'-6"
- Window Height @ 6.5 feet › Shade Depth of 4', Height of 1'-11"
- Window Height @ 7 feet (Door) › Shade Depth of 4'-5", Height of 2'-2"



2.1.i - Basement Walls and Slab

Either R-15 continuous insulation on the interior or exterior of the basement walls is recommended in this climate zone. Alternatively, R-13 cavity insulation + R-5 continuous insulation on the interior or exterior would also comply with energy code requirements. A final option would be to provide R-19 cavity insulation on the interior of the basement walls.

The full slab perimeter should include edge insulation of R-10 for 2 feet (not extended below the slab).

2.1.j - Separate Conditioned Space

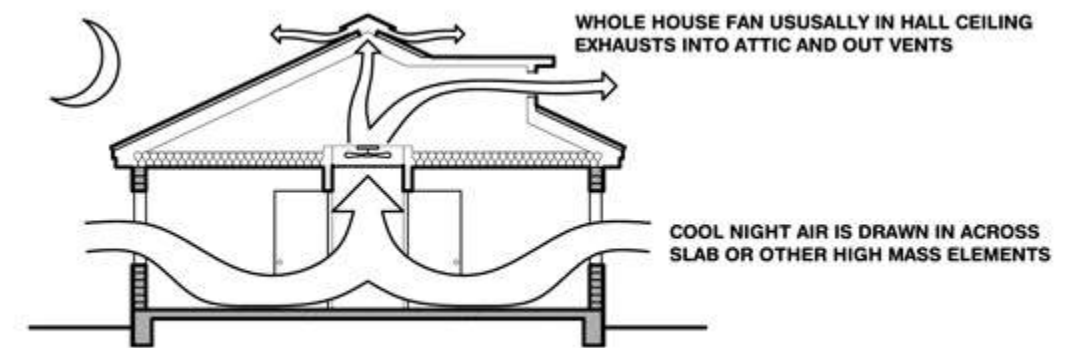
Thermal envelope should be continued between house and garage, separating garage from indoor spaces with insulation, air barrier, and vapor retarder. Assuming the garage isn't heated or cooled to > 1.0 Watt/ft² of floor area, which in this case would mean no more than a 268 W heater. Attention to the air barrier between garage and home should also be specifically considered and maintained to prevent any exhaust fumes from entering the living space. A self-closing door should be provided for all connecting doors into the home.

2.1.k - Functional Exterior Space

Screened porches and patios can provide passive comfort cooling by ventilation in warm weather and also prevent insect problems. Shaded outdoor buffer zones (porch, patio, lanai) oriented to prevailing breezes can extend living and working areas outdoors.

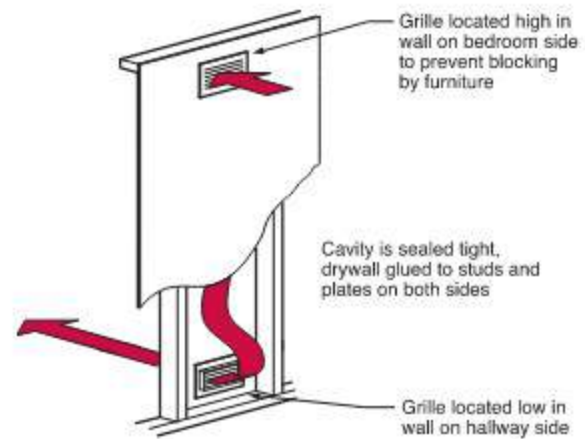
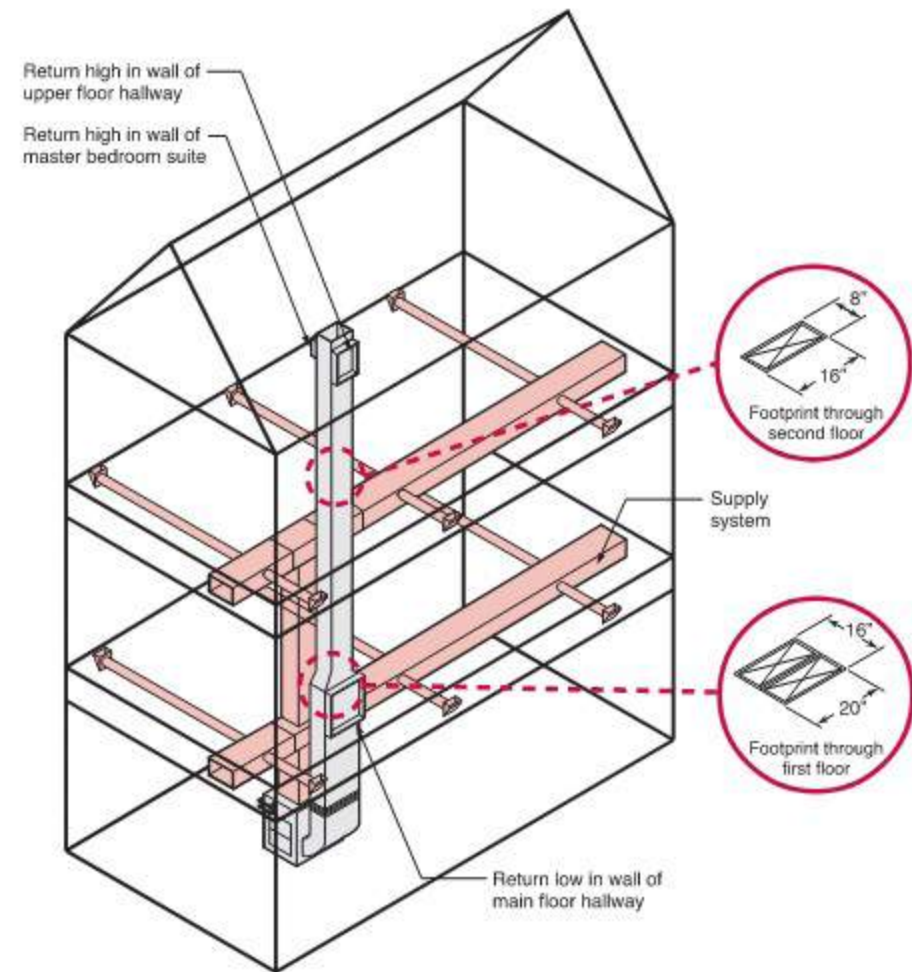
2.2 - HVAC Best Practices

- Do NOT use flexible ductwork, which has a large pressure drop and can prevent air from getting where it should be.
- Install an air conditioner or heat pump with Seasonal Energy Efficiency Ratio (SEER) of at least 16 (or higher) to be eligible for maximum rebates. Associated savings for a 3-ton air conditioner are on the order of:
 - 13 SEER › 16 SEER = 19% per year & \$1,600 – 2,200 savings¹
 - 13 SEER › 20 SEER = 35% per year & \$2,600 – 3,600 savings
 - 13 SEER › 25 SEER = 48% per year & \$3,400 – 4,800 savings
- Install a furnace with AFUE of 92% or 96% (rather than standard efficiency of 80%). Payback would around 3-4 years for both options, with annual savings of 13 or 17%.
- Include a smart thermostat (see link from OPPD rebate) that will pay for itself, plus rebate, make automatic setbacks and save ongoing energy via summer demand program.
- On hot days, ceiling or floor fans can make it feel cooler by 5°F or more, reducing the need and cost for air conditioning.
- A whole-house fan can help eliminate the need for air conditioning during cool evenings.



- Mechanical equipment and ductwork should not be located outside of a home's thermal barrier and air pressure boundary (air barrier, typically). It is possible to construct unvented, conditioned attics that can be good locations for furnaces and ductwork, with attention to detail.
- Clear pathways for return air should be maintained via ducted return, transfer grilles, jump ducts or a combination of these, from bedrooms through common areas and back to air handlers (typically furnaces / heat pumps). Do not use building cavities as returns.
- Leave space allocations for ductwork between floors (vertically) during floor plan layout to minimize changes to framing during HVAC construction. Plan for ductwork sizing (at around 0.8" pressure drop) plus 2" on each side for R-6 insulation, plus 1-1/2" clearance. Do not install ductwork in exterior walls.
- For better indoor air quality, consider sealed combustion appliances or heat pumps with backup electric resistance heat.
- Ductwork leakage should be limited to 5% of the total air handling system rated air flow at high speed (nominal 400 cfm per ton), determined by pressurization testing at 25 Pa. At time of rough-in for this application, total duct leakage should be < 72 cfm.

¹ Assumes 50-20 year equipment life, with 3% per year electrical cost escalation and \$350 OPPD rebate



5 - New Construction Air Distribution Systems: Builder's Guide to Cold Climates, © Lstiburek

- Ventilation should be an integral part of the HVAC system design (15 cfm per primary bedroom and 7.5 cfm for each additional bedroom, minimum. Consider an ERV (energy recovery ventilator) to provide continuous exhaust and ventilation with a payback of < 4 years, depending on use and options.
 - Kitchen intermittent exhaust of 100 cfm could be provided (general exhaust) in addition to range hood vented to the outside (non-recirculating).
 - Restroom intermittent exhaust of 50 cfm or continuous exhaust of 20 cfm per bathroom should be provided.
- Minimum fan efficacy (cfm / W) of HVAC equipment should be as follows:
 - HRV or ERV: 1.2 cfm / W
 - Range Hoods: 2.8 cfm / W
 - Bathroom / utility room fan < 90 cfm: 1.4 cfm / W
 - In-line Fan, or Bathroom / utility room fan ≥ 90 cfm: 2.8 cfm / W
- Carbon monoxide detectors should be installed (one per floor) and hard-wired. Locations should be adjacent to combustion equipment (water heater and furnace) and garage.
- Consider an exhaust fan for the garage (75 cfm) that meets requirements for cfm / W as listed above. Fan should vent directly outdoors and have an automatic timer control linked to an occupant sensor, light switch, garage door mechanism, or carbon monoxide sensor set to turn on fan when CO ≥ 35 ppm.
- HVAC filtration should be provided at MERV 10 or higher, with reasonable filter access.
- Provide permanent walk-off mats at each primary entryway from outdoors (at least 4-feet long in the distance of travel). Include shoe removal and storage space near primary entryway, separated from living areas. It should accommodate at least 2 pairs of shoes per bedroom and not be carpeted.

2.3 - Lighting & Electrical Best Practices

- Install high-efficacy lighting, capable of meeting 16 weighted average footcandles. Limit lighting power density for hard-wired fixtures to ≤ 0.48 W / ft² accounting for all fixtures total.
- Utilize dark sky qualified exterior lights with photocell or timeclock controls.
- Seal around all penetrations in air barrier.

2.4 - Plumbing Best Practices

- Stacked plumbing is critical to minimize expensive maintenance repairs and demolition of ceilings and walls.
- Current floor plans show the kitchen wet wall back-to-back with the restroom, so this wall should be thicker to accommodate piping for both.
- Space for water meter and service entrance (approximately 3 feet length x 2 feet depth clear space) should be located with the main waste and vent stack in the utility room on the lower level.
- Consider gas meter location, which should be planned to include 3 feet of working distance around the meter set outdoors. It should also be located away from windows by the same.
- Utilize a high efficiency water heater, ENERGY STAR rated if possible. Sealed combustion gas water heaters (instantaneous or tank type). Combustion appliances inside conditioned spaces should be power-vented or sealed combustion.
- No piping should be located in exterior walls. Air-seal around plumbing penetrations in air barrier such as rim joist.
- How water distribution and recirculation (if present) should be insulated to ≥ R-3.
- Maximum flow rates for fixtures: shower (2.5 gpm), faucets (2.2 gpm), toilets (1.6 gpc), clothes washer (9.5 WF), dishwasher (6.5 gpc). Ideally all fixtures should be EPA WaterSense rated.
- Water pressure should not exceed 60 psi.
- Any water softeners should be demand-initiated.

2.5 - Other Things to Consider

- Average estimated life expectancy of a home build today is 50 years (with a goal to create generational wealth of at least two generations). Even now, over the last few years we have seen and will likely continue to see rapid changes to technology, incentives, and community interest in things like electrification, renewable energy, and electric vehicles. Planning for the future implementation of these concepts can be accommodated through the following:

2.5.a - Renewable Energy (solar photovoltaic)

- **On-Site Solar:** Installation of solar panels on the roof is typically the least expensive type, as support structure is largely already in place. Orientation of the roof and percentage of roof area available for coverage plays a role in total potential output. All relevant roof warranties should also be considered before location is determined.
- Notes below assume an example installation as shown:
- Avoid shading from trees, buildings, future known construction, etc.
- South-facing roof slope will optimize system performance. Keep this obstruction-free if possible. Minimize roof

- penetrations or locate on non-south facing roof structures.
- Roof construction can greatly affect the cost of installing solar at a later date. The roof must be capable of carrying the load of the future solar panels (6 lbs / ft²). Install permanent roof anchor fall safety system (NA for roof pitch ≤ 3:12).
- Wind loads on rooftop solar should be considered to ensure structure is sufficient.
- If solar is to be installed with penetrating hardware on the roof, consider installing mounting hardware at the time roof is constructed and use flashings for every penetration.
- Identify electrical panel location for convenient PV system inter-connection. Potentially in the garage, in this case, and save space for a PV circuit breaker (if future installation).
 - Panel capacity should be sufficient to accommodate total power input of PV, 70 amp dual pole circuit breaker, labeled.
- Install and label a 4'x4' plywood panel for mounting an inverter and system components. Include a 1" metal conduit for the DC wire run from the designated array location to the inverter location (cap and label both ends). Install a 1" metal conduit from inverter location to electrical service panel as well.
- Cost / payback example** (assuming 1/2 of roof area for solar), could total an approximate roof-mounted solar array installation of 14 kW might total output of approximately 19,800 kWh/yr, saving nearly \$2,000 in year one. Assuming utility escalation rate of 3% per year could result in a payback of 11 years (without tax credits) and 9 years (with a 22% tax credit).

2.5.b - Electric Vehicles

- Most EVs can charge on one of two charging levels. The level you chose will determine how fast your EV will charge. Level 1 charging can typically be done using standard outlets. For Level 2 charging or higher, a 240-volt circuit should be run to the garage or other parking location.

2.5.c - Site Plantings

- Use plant materials (bushes, trees, ivy-covered walls) especially on the west side, to minimize afternoon heat gain. Favor native or adapted low-water use plantings and if sprinklers are installed, utilize a weather controller or rain sensor ([rebate available from MUD](#)). Lists of native plants are maintained by the [Lady Bird Johnson Wildflower Center](#), the [North American Native Plant Society](#), state agencies, and local education cooperatives (like [UNL Extension](#)).

2.5.d - Healthy Materials

- Prioritize materials and finishes that have low-VOC content, and are certified as such, with HPD's, EPD's, Green Seal, Red List Free, BIFMA, Benchmark, Green Label, FloorScore, NSF / ANSI 332, UL Greenguard, SCS International Advantage, or Blue Angel. Additional product guidance is available at <https://www.buildinggreen.com/product-guidance> or [How to Find Indoor airPLUS Compliant Low-Emission Products](#) from the EPA.
- Any composite wood** products should be certified low-emission to PS1 or PS1, as appropriate, and made with moisture-resistant adhesives as indicated by "exposure 1" or 'exterior' on the American Plywood Association (APA) trademark. **Hardwood plywood** should be certified compliant with formaldehyde emissions requirements of ANSI/HPVA HP-1-2016; California Air Resources Board (CARB) Airborne Toxics Control Measure (ATCM) Phase II to Reduce Formaldehyde Emissions from Composite Wood Products; OR EPA Toxic Substances Control Act (TSCA) Title VI certified. **Particleboard and MDF** products should be certified compliant with CARB ATCM Phase II to Reduce Formaldehyde Emissions from Composite Wood Products; EPA Toxic Substances Control Act (TSCA) Title VI certified; Formaldehyde emissions requirements of ANSI A208.1 (particleboard) and A208.2 (MDF); ECC Sustainability Standard by the Composite Panel Association; OR GREENGUARD or GREENGUARD GOLD Certification. **Cabinetry** made with component materials (plywood, particleboard, MDF) should be certified to comply with the appropriate standards above; be products produced in plants certified under the Kitchen Cabinet Manufacturers Association's (KCMA) Environmental Stewardship Certification Program (ESP 05-12); OR GREENGUARD or GREENGUARD GOLD Certification for Cabinetry.
- Paints and coatings** should be certified to GREENGUARD GOLD, Scientific Certification Systems (SCS) Standard EC-10.3-2014, Indoor Advantage Gold, a third-party low-emitting product list based on CA Section 01350 (CDPH Standard Method V1.2-2017), Green Seal Standard GS-11, Green Wise and Green Wise Gold products, OR Master Painters Institute (MPI) Green Performance Standards X-Green, GPS-1 or GPS-2.
- Carpets and carpet adhesives** should be labeled with, or otherwise documented as meeting, the Carpet and Rug Institute (CRI) Green Label Plus testing program criteria. For carpet cushion (i.e., padding), use only products certified to meet the CRI Green Label Plus testing program criteria.
- Site-applied interior adhesives and sealants** should be low-VOC or no-VOC products certified by a third-party low-emitting product list based on CA Section 01350 (CDPH Standard Method V1.2-2010), Green Seal GS-36, OR GREENGUARD or GREENGUARD GOLD certification for adhesives and sealants.

- Interior hard surface flooring materials, adhesives, and underlayments** be low-VOC or no-VOC emitting as certified by one of the following third-party standards or certifications: FloorScore®; GREENGUARD or GREENGUARD Gold; SCS Indoor Advantage Gold; a third party low-emitting product list based on CA Section 01350 (CDPH Standard Method v1.2-2017); OR CRI Green Label Plus (adhesives).

2.5.e - Homeowner Education

- Provide resident(s), with information and documentation of the home's Operations and maintenance instruction manuals for all installed equipment and systems, including HVAC systems and accessories, dehumidifiers, combustion appliances and any radon system (if required). Provide the homebuyer with information that addresses the importance of ensuring that manually controlled ventilation options (e.g., bathroom, garage, kitchen exhaust fans; operable windows, and doors, etc.) are used when strong pollutant sources are present, such as when using common household products (e.g., cleaning products, pesticides) and when using the garage for hobbies or other pollutant generating activities.

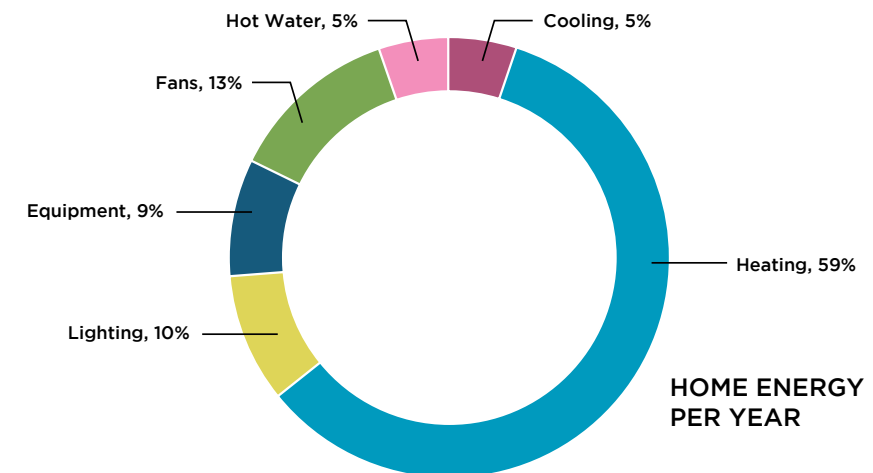
Section 3.0 - Energy Modeling Bundles

Table 5 - Energy Modeling Inputs

| Input | Baseline | Iterative Options |
|--------------------------|------------------------------|--|
| WINDOW U-VALUE | 0.3 BTU/h ft ² F | U-0.31 / 0.26, U-0.29 / 0.25, U-0.20 / 0.23, U-0.25 / 0.20, U-0.29 / 0.73, U-0.23 / 0.61, U-0.16 / 0.56, U-0.20 / 0.53 |
| WINDOW SHGC | 0.5 | |
| AIR LEAKAGE | | 3 ACH50 (0.1 cfm / ft ²) |
| ROOF R-VALUE | R-34.5 | 40, 45, 50, 60 |
| WALL R-VALUE | R-16.7 (U-factor 0.06) | 21, 28, 33, 35, 42 |
| BELOW GRADE WALL U-VALUE | | 0.05 BTU/h ft ² F |
| FLOOR U-VALUE | 0.03 BTU/h ft ² F | |
| THERMOSTAT SET-POINT | | 72°F cooling (75°F setback) 70°F heating (67°F setback) |
| HEATING SYSTEM | | 80% efficient gas furnace |
| COOLING SYSTEM | | 13 SEER split system DX air conditioner/condensing unit (3.2 COP) |
| VENTILATION | | 15 CFM per person (75 total), continuous |

Results show energy use distribution typical for our climate zone, with heating predominantly consuming the most energy on an annual basis.

These bundle recommendations are based on energy modeling results using a range of inputs with one typical floor plan ("walkout basement" as shown below, assuming plan North):



The chart below shows relative sensitivity analysis impact (high/low energy savings potential and cost) for different potential design decisions and system selections.

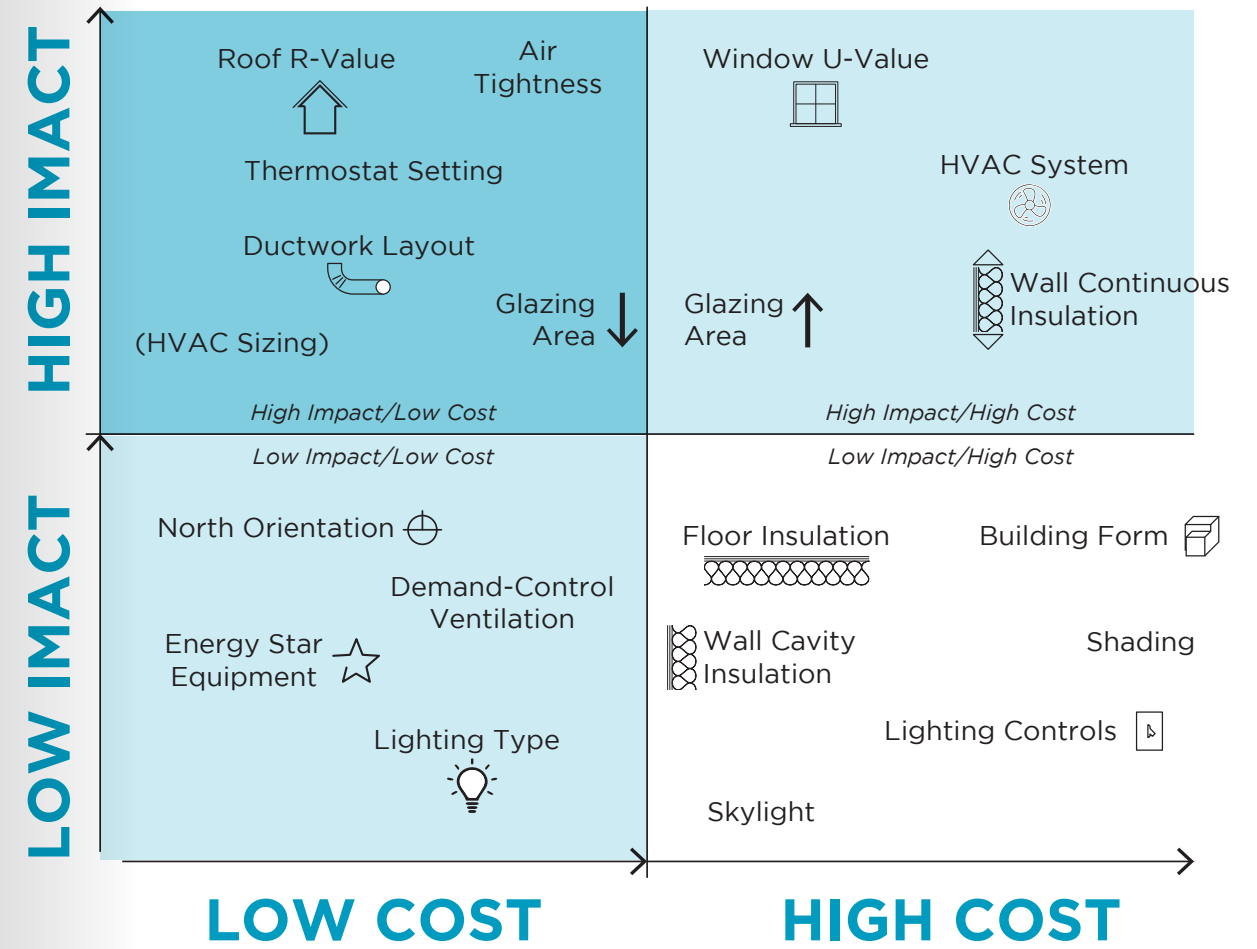
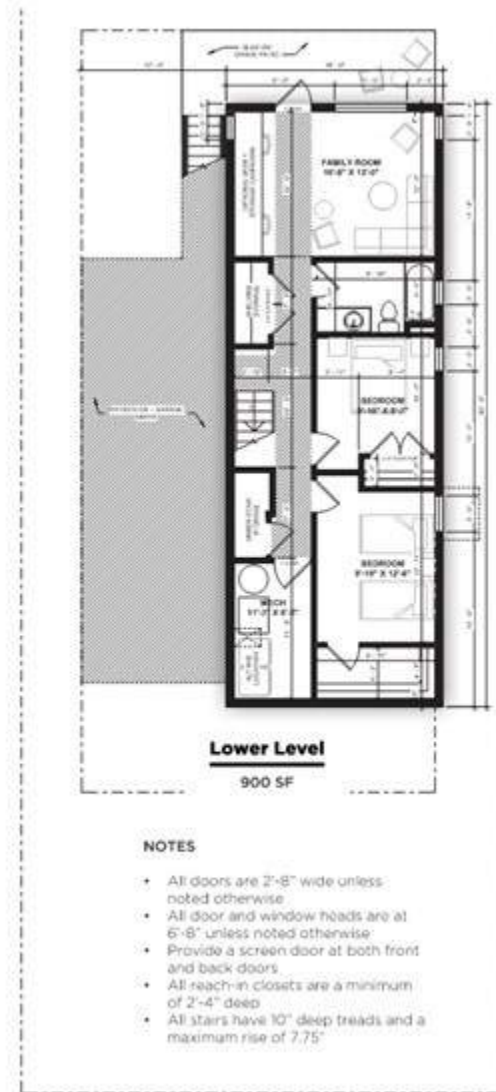
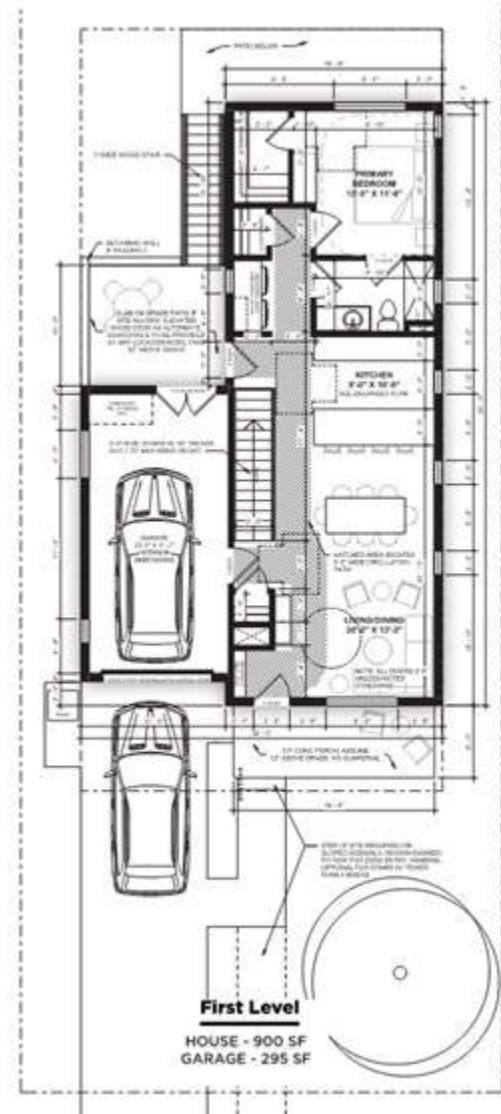


Table 6 - Energy Modeling Bundles

| Input | Baseline | Bundle 01 | Bundle 02 | Bundle 03 |
|----------------|-----------------------------|--|------------------------------|------------------------------|
| WINDOW U-VALUE | 0.3 BYU/h ft ² F | 0.23 BTU/H FT ² F | 0.16 BTU/H FT ² F | 0.20 BTU/H FT ² F |
| WINDOW SHGC | 0.5 | 0.61 | 0.56 | 0.23 |
| ROOF R-VALUE | R-34.5 | R-34.5 | R-45 | R-60 |
| WALL R-VALUE | R-16.7 | R-16.7 | R-16.7 | R-20 |
| COST PREMIUM | Baseline (none) | Could be added if \$/SF values are provided for enclosure variable inputs in Table 5 | | |
| PAYBACK (YRS)* | | | | |
| ENERGY SAVINGS | | | | |

Section 4.0 - Rebates & Incentive Programs

There are several program options available that would be applicable to implementation of the energy efficiency measures described above, available from Omaha Public Power District.

- [Certified High-Performance Home \(CHPH\) Rebates](#)
- [Electric Vehicle \(EV\) Rebate](#)
- [HVAC Smart Rebate Program](#)
- [Cool Smart Program](#)
- [Smart Thermostat Program](#)

The current tax credits for Residential Energy Efficiency ([Equipment Tax Credits for Primary Residences](#)) as well as the tax credit for [builders of energy efficient homes](#) expired on December 31, 2021. As of January 5, 2022, there is no approved extension of these tax credits. Any extension/renewal of these credits is still pending approved legislation by Congress. We will update our website with updates when there is an approved bill. The tax credits for [Residential Renewable Energy Products](#) are still effective, as written on this site, through December 31, 2023.

Programs like the [federal Weatherization Assistance Program \(WAP\)](#) contract with local government programs, in this case the [Nebraska Weatherization Assistance Program](#), to enable low-income families to reduce their energy bills by making homes more energy efficient.

The [Low Income Home Energy Assistance Program](#) (LIHEAP) provides resources to assist families with home energy bills, energy crises, weatherization and energy-related home repairs. This grant program is administered through the [Nebraska Department of Health and Human Services](#) currently.

Appendix A - Reference Information

Other reference documents, standards, codes, and programs utilized:

- 2018 IECC (International Energy Conservation Code)
- ASHRAE 90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings
- [EPA Indoor airPLUS v2](#)
- RESNET HERS Index and [Standards](#)
- DOE Resources:
 - [Advanced Building Construction Collaborative](#)
 - [Zero Energy Ready Homes](#)
 - [Home Performance with ENERGY STAR®](#) / Energy Star for Homes
 - [Home Energy Score](#)
 - [The Building America Solution Center](#)
- Builder's Guide to Cold Climates by Joseph Lstiburek, Building Science Corporation (2012)
- LEED v4.1 for Residential Design and Construction (Single Family)
- [USGBC Green Home Guide](#)



