

# GREEN RIVER

## Vernacular Housing Study & Best Practices



EPICENTER

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# PURPOSE

## eliminate substandard housing in Green River

Green River is in dire need of not just affordable housing but also durable and efficient housing to replace our deteriorated housing stock. Astonishingly, trailers account for 28% of total housing units in Green River (compared to 6% nationwide or 4% in Utah). And, based on a recent study by Epicenter, 69% of all trailers are built before July 1976, before HUD established a national building code for mobile homes. Of all housing types in Green River, still the figure is high: 47% of all homes are in need of repairs (ref: 2012 Green River Housing Plan). We seek to eliminate substandard housing in Green River through a holistic approach including home repairs (via our award-winning Fix It First program), new multi-family housing construction (currently in pre-development), and through our design and construction of the Frontier House by the end of 2016.

This report acts as a guide for precedent and best practices for the Frontier House and any future single-family construction in Green River.

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# UTAH HOUSING TYPES

## a brief overview

Green River includes numerous examples of historic Utah housing types dating back to the 1800s. These types include:



### Hall-Parlor/Central Passage (1847-1910)

The hall-parlor type is rectangular in shape with a gabled roof. Entry is in the center of the length of the house. The plan consists of one large square room (the hall) and a smaller adjoining room (the parlor). The plan is asymmetrical, though the facade is symmetrical. Second or one-and-a-half story variations are common.



### Homestead Temple (1900-1920)

The homestead temple form is similar to the hall-parlor except that the entry is located on the gable side of the house, often covered by a porch. They tended to be mass-produced in communities experiencing a population increase related to an economic boom of some sort.



### Ranch (1945-1980)

The ranch style is a long rectangle that gathers living areas on one end and bedrooms connected by a central hall on the other. This style transferred outdoor emphasis from the front porch to the back yard. This style is one story only.



### Cross-wing (1880-1910)

The cross-wing type features an "L" or "T" shaped floor plan. Entry is usually in the intersecting wing where the two wings meet. One-and-a-half story variations are common.



### Bungalow (1905-1925)

The bungalow is rectangular in shape and features either an Arts and Crafts gabled or low-pitched Prairie School-style hip roof. They tend to be low to the ground and feature deep porches with battered half-walls that create a sense of refuge. One-and-a-half story variations are common.



### Mobile Home (1950-)

Mobile homes exist in an awkward space between vehicle and house. They are treated as vehicles by state licensing agencies and like vehicles depreciate in value. Mobile homes are a narrow rectangle in plan and group living areas on one side and bedrooms connected by a narrow hall on the other.



### Foursquare (1900-1920)

The foursquare is square in shape with a hip roof. Entry generally leads directly into a living area. The plan consists of four rooms of roughly equal size, though additions are often common, as are two- and one-and-a-half story variations.



### WWII-era Cottage (1940-1950)

Variations of this cottage in Green River can be seen as a variation of the foursquare plan, but are rarely more than one story. They feature hip roofs or very shallow gables. Green River features several cottages built elsewhere and later moved to town.



### Manufactured Homes (1960-)

Manufactured homes represent a further in-between of mobile homes and traditional stick-built homes. Though more permanent than mobile homes, they exhibit the same long rectangular shape and plan with a ranch style facade.

# BEST PRACTICES

## scale & character

A good house design considers not only interior space and specific site placement but also the character and scale of the houses and landscape around it. Buildings that pay attention to their context can create a cohesive yet diverse neighborhood. All houses need not be the same, but should keep in mind the character of other houses, including height, materials, overall size, or relation to the street. For example, a large two-story house that presents its broadside to the street will feel out of scale in a neighborhood of primarily one-story houses or houses with smaller, compact footprints (photo F). A house can maintain a strong character and presence without being out of scale (photo E).

The character and details of a house can also lead it to feel either cohesive or out of place. For example, the barn roof of the house in photo B creates a usable second story space but with a form out-of-place on a domestic building. The house in photo A, however, creates a similar second story area with a highly pitched roof but in a manner cohesive with surrounding houses.

The house in photo D creates an awkwardly proportioned and not very usable second story with an odd form that attracts attention to the faults of the space and construction. The house in photo C creates a second story space while still preserving the compact form of the home, creating a cohesive and inviting façade.

The house in photo G is new construction and a simple design with few visual construction details, but it still features carefully considered elements like a steeply pitched roof, 2:1 proportioned windows, and a raised, east-facing porch that a manufactured home such as the one in photo H does not exhibit (the very shallow roof pitch is particularly noticeable as out of place with other houses in town).

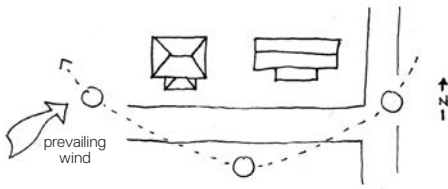
On the other hand, all details are not beneficial. The house in photo I features construction details such as bracketed roof supports on the gable, a bay window, and battered half walls on the porch that enhance the lived space and façade of the house. The house in photo J, however, features unnecessary corners, gables, and window treatment that create an overly busy façade without enhancing the lived space of the home.





# BEST PRACTICES

## planning & orientation



### Orientation

The biggest cost savings comes from properly orienting the house on the site. In this climate, a square, compact plan is best. If the plan is rectangular, the long dimension should run east-west to avoid the hot afternoon sun as much as possible while bringing in natural light from the south and north.

Cost and benefit: No extra cost, dramatic benefit on heating, cooling, and lighting costs.

### Ventilation and Natural Light

Well-designed homes take into account opportunities for natural ventilation and light. Narrow floor plans allow for cross breezes which can keep a home comfortable without using mechanical cooling.

Window placement and size is critical for allowing natural light while providing privacy when desired. Windows placed near a room corner will cast light onto the wall in a way that increases the brightness of the space with less overall glazing.

Cost and benefit: No extra cost, saves money in ongoing utility costs.

### Hallways

In the timeline of housing, hallways are relatively new. During the Renaissance, halls were wide gathering spaces. Nowadays they are solely pathways of circulation and therefore cut down on the amount of usable space in a home. A well-designed floor plan limits hallways, using them only for privacy, such as outside a bathroom, and serve a dual purpose, such as a good location for closets and washers/dryers.

Cost and benefit: No extra cost, allows for more money to be spent on usable spaces.



### Outdoor Space

The space surrounding a house is just as important as the design of the house itself. In Green River, anything left as dirt will quickly turn to mud with the smallest bit of moisture (above).

Xeriscaping—using non-plant ground cover like rocks and native, low-water plants—is most appropriate for this climate. When water-demanding grass is desired, limit it to specific areas where it will be most beneficial. Use landscaping barriers to break up different zones of material type and size to create designed exterior spaces (below).

Fences or hedgerows can create a boundary and protection between the street and yard. Consider how outdoor space may act as another room of the house, and how hedges, fences, trees, and plantings can shape that room and the activities that may occur there.



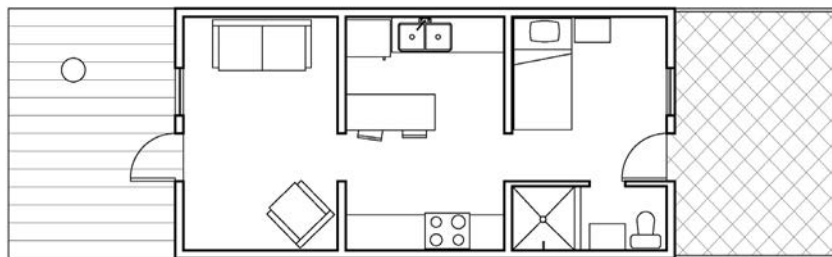
### Porches

South-side porches provide a buffer between the interior of the house and the elements. East-facing porches allow for the most use as they are protected from sun much of the day. Because of mosquitoes and other bugs present in the summer, porches should be screened to maximize use, especially during the evening when the outdoor temperature is nicest but the bugs are most active.



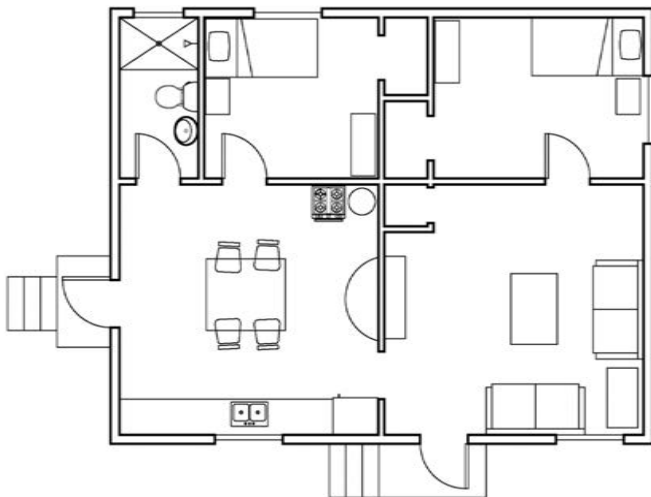
# BEST PRACTICES

## example plans



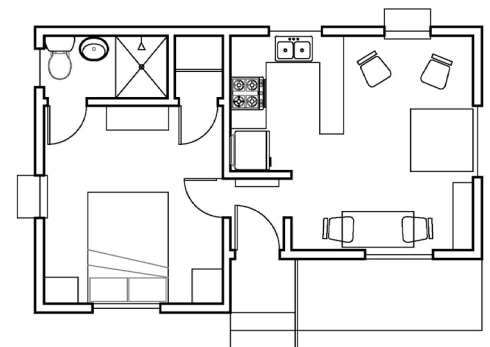
### Shotgun

This plan divides living space into three rooms: a living area, a kitchen and dining area, and a bedroom in 392 square feet, plus outdoor space.



### Foursquare

This modified foursquare features a kitchen and dining room, living room, two bedrooms, and full bath in 738 square feet.



### Compact

This plan divides living space into two rooms: a public living/dining/kitchen space and a private bedroom in 318 square feet.

# BEST PRACTICES

## materials & construction



### Siding

Vinyl siding (above) rots from UV rays and becomes brittle and discolored. Replacing vinyl siding often means having mismatched colors. Vinyl siding is not impact resistant; once UV rays degrade the siding, a ball thrown against the house or even something shooting out from a lawn mower can cause holes and cracks, which lead to water infiltration. Additionally, the hot western sun expands vinyl and cause rippling (above). Vinyl siding is also arguably toxic in its production and makeup and is not easily recycled. Alternatively, aluminum and fiber-cement board siding provide much better durability. Fiber-cement board siding requires dust masks when cutting, but is otherwise non-toxic and recycles the waste product fly ash in its production. Fiber-cement board is cheaper than vinyl, impact-resistant, and can be painted any color any time. It comes in 12' boards with multiple exposure options, in 24" shingles, or in 4'x8'/10'/12' sheets. The boards install like wood lap siding and are warranted for 35 years.

Cost and benefit: Fiber-cement board costs slightly less than vinyl and is much more durable.

### Windows

Quality windows matter. The most heat is lost in winter or gained in summer through windows and doors. Wood-framed windows are classic but perform worse than high-quality vinyl windows, which are made with air chambers that reduce heat bridges. The two or three pieces of glass create an air pocket (filled with insulative gas) to minimize heat transfer through windows. Always choose double-pane over single-pane. Even more efficient triple-pane windows become more affordable each day. By code, windows must constitute 8% of the exterior walls. It's best to stick close to the minimum, placing windows where they will maximize natural light and views.



### Water Wall Location

Walls containing plumbing (water walls) require 2x6 studs at minimum. It's best to consolidate plumbing on an interior wall to prevent freezing. This efficiency reduces money spent on service pipes and saves energy by locating the water heater as close to water-use areas as possible. Instantaneous water heaters are an option for water-use away from a consolidated wall.

Cost and benefit: No additional design costs, saves money in materials, labor, and ongoing utility costs.

### Insulation

Heat bridges (caused by studs transferring heat through the wall) should be avoided as much as possible. Studs at 24" on center (as opposed to the typical 16" on center) reduce the number of heat bridges in a wall by 33%. Spray foam insulation in the form of polyisocyanurate (R-5 per inch) is preferred to more common fiberglass batt insulation (R-3.4 per inch), as it seals gaps that allow air infiltration, a major contributor to heat loss/gain. Due to spray foam's cost (materials and specialized labor for install), a compromise is to use spray foam for the first inch of the wall and fiberglass batts for the remainder, resulting in a wall R-value of 23 for a 2x6 stud wall.

Cost and benefit: One inch of foam adds about \$11 per linear foot of exterior wall (including labor), results in lower ongoing utility costs.

### No/Low VOC Materials

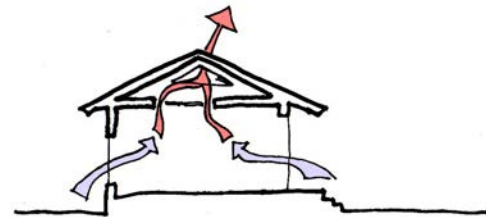
Humans recognize VOCs (volatile organic compounds) most easily by the smell, often in paint, caulks, glues, and carpet (that "new car smell" is harmful fumes). When possible, choose products certified "no VOC" or at least "low VOC" to protect both the builders and you, as indoor air quality is affected most by the presence of VOCs.



### Roofing

Asphalt shingle roofs (above) are very common. However, in very sunny and windy Green River, they are a poor option, and the companies that make them provide a limited warranty of 15 to 25 years at most. Alternatively, metal roofs come with a 40-year warranty and are easier to install. Even though metal costs more than asphalt shingles, the costs work out to be the same when including labor. A reflective (unpainted) roof reflects 95% of the radiant heat from the sun; a white roof reflects 90%, and colors reflect less. The lighter the color the better—for any roof—whether it be metal or shingle. Additionally, installing foil-covered OSB substructure as a radiant barrier provides more heat protection.

Cost and benefit: Including labor, metal costs the same as asphalt shingles and is more durable.



### Whole House Fans

Also called attic fans, whole house fans are installed in a central location in the ceiling of a house. They are used for about five minutes a day in the late afternoon. By simply opening the windows and doors and turning on the fan for five minutes, the air in the attic is exhausted out of the eave vents, cutting down the temperature in the attic dramatically and reducing the "blanket" effect heat trapped in the attic has on the house at night.

Cost and benefit: \$220 for fan, saves money in ongoing utility costs.



# BEST PRACTICES

## materials & construction



### Swamp Cooler Placement

Swamp coolers use evaporative cooling and work well in this climate. However, they can create many complications when they are placed on the roof (as seen above). The continuous flow of water can easily create roof or ceiling damage if they are not routinely inspected and maintained.

The best placement of a swamp cooler is on the north side of the house and shaded from the hot afternoon sun, as they tend to easily overheat.

### Interior Flooring

Hardwood floors are the best option for durability and indoor air quality (tile floors in bathrooms are also a good option). Rugs can be added for comfort. Rugs, as opposed to carpet, can be taken outside and beaten to remove dust and dirt and replaced when needed. Carpet has the major disadvantage of off-gassing for up to seven years after its installation, causing bad indoor air quality. Carpet also collects allergens that contribute to poor health.

Cost and benefit: Hardwood costs more than carpet (\$3-4 per SF versus \$1 per SF) but hardwood can last for over 100 years with periodic maintenance while carpet needs replacement every 5-15 years depending on quality.

### A Note on Manufactured Homes

Manufactured homes achieve their affordable prices not only through the efficiency of factory construction but also through lower quality construction methods. Manufactured homes typically have a fixed layout determined by the fact that they will be delivered by truck. This layout doesn't allow for site specificity with porches or windows. Buyers are usually tempted by the sticker price of the home, which doesn't include land, fees, or foundations, that can be significant and cause the home to be as expensive as stick-built homes.



### Good & Bad Additions

Additions to existing homes are common in Green River and can be a cost-effective way to expand the space of a home as family size increases. However, without proper construction techniques additions can be difficult to connect and weatherproof (C). This can often lead to the additions sagging or leaking at the roof and walls.

Additions that attempt to extend the profile of the house are very difficult to execute well (C). Some additions work well with existing house's proportions and aesthetics but are poorly constructed (E).

Shed roof additions can be the simplest to construct and the easiest to visually harmonize with the existing house (A). However, the existing structure must have a high eave line so that the shed roof added below the eave line can slope downward without creating a low ceiling (B, D).

In Green River you can see many adaptations to make trailers look more like traditional homes (F). Although these additions can make the space more usable, the value of the home is still depreciating each year, meaning the money and time put into renovations on the trailers doesn't have any return value.



Many houses in Green River feature an upper half story that maximizes use of the attic space (A). Though this is an efficient way to expand usable interior space, it eliminates the buffer between interior and exterior an attic provides, causing the upper story to be difficult to keep cool, a situation further exacerbated by dark-colored roofs that absorb heat.

# LOCAL EXAMPLES

## hall-parlor



### Pros

- fence provides a buffer to the street
- 1.5 stories keep low profile while maximizing space
- maintained yard adds to appeal of house

### Cons

- broadside orientation to the west
- west-facing porch
- asphalt shingles deteriorate quickly
- dark roof absorbs heat to already hot second story
- all-wood construction weathers quickly



### Pros

- length runs east-west
- well-proportioned roof
- nice window rhythm
- metal roof works best in this climate
- concrete block is a durable material

### Cons

- no porch



### Pros

- length run east-west
- compact, four corner design

### Cons

- all-wood construction weathers quickly
- no porch

## cross-wing



### Pros

- narrow windows accentuate height
- additional "L" doubles size of house

### Cons

- all-wood construction weathers quickly
- no porch or any sort of buffer to the street



### Pros

- compact floor plan
- durable aluminum siding
- siding color change references historic homes

### Cons

- entry is difficult to find



### Pros

- fiber cement siding works best in this climate
- reflective metal roof works best in this climate
- white color reflects heat
- attic/whole house fan
- efficient heat pump system
- 2:1 proportion high-quality vinyl windows
- 2x6 stud walls two feet on center
- hardwood floors
- spray foam/batt insulation combination
- east-facing porch
- no west-facing windows
- no space-wasting hallways



# LOCAL EXAMPLES

## foursquare & WWII-era cottage



### Pros

- compact, four-corner floor plan
- east-facing porch
- interior space above porch uses existing structure
- white color reflects heat
- high roof slope quickly sheds water and ice; adds space for attic heat buffer

### Cons

- all-wood construction weathers easily
- asphalt shingles deteriorate quickly



### Pros

- compact, four-corner floor plan
- east-facing porch
- white color reflects heat
- high roof slope quickly sheds water and ice; adds space for attic heat buffer

### Cons

- all-wood construction weathers easily
- asphalt shingles deteriorate quickly



### Pros

- compact, four-corner floor plan, central heating
- east-facing porch (even better: it's screened)
- white color reflects heat
- high roof slope quickly sheds water and ice; adds space for attic heat buffer

### Cons

- asphalt shingles deteriorate quickly
- rear kitchen and bath addition not well-constructed
- asphalt shingles deteriorate quickly



### Pros

- compact four corner floor plan
- high roof slope quickly sheds water and ice; adds space for attic heat buffer

### Cons

- all-wood construction weathers quickly
- no porch
- highly exposed siting



### Pros

- compact four corner floor plan
- reflective metal roof works best in this climate
- durable aluminum siding
- few windows reduce heat gain and loss without sacrificing natural light
- white color reflects heat
- high roof slope quickly sheds water and ice; adds space for attic heat buffer

### Cons

- no porch or significant buffer to street
- hard to expand or add an addition



### Pros

- compact four corner floor plan
- low-slung roof makes for a wide house of equal width and depth
- full-length porch (though north-facing isn't ideal)
- trees provide natural shade
- white color reflects heat

### Cons

- asphalt shingles deteriorate quickly



# LOCAL EXAMPLES

## homestead temple



### Pros

- compact, four-corner floor plan
- metal roof works best in this climate
- east-facing porch
- fence provides buffer to street
- rear deck shaded by trees
- gingerbread detailing adds character

### Cons

- dark roof absorbs heat



### Pros

- compact, four-corner floor plan
- 1.5 story design allows for the shed roof additions
- siding color change references historic homes

### Cons

- north-facing porch provides a buffer to the street but not a usable outdoor space
- asphalt shingles deteriorate quickly



### Pros

- compact, four-corner floor plan
- metal roof works best in this climate
- hedge provides buffer to the street
- siding color change references historic homes

### Cons

- no porch



### Pros

- compact, four-corner floor plan
- raised south-facing porch
- symmetrical, but window rhythm adds interest

### Cons

- asphalt shingles deteriorate quickly



### Pros

- compact, four-corner floor plan

### Cons

- no porch or significant buffer to street
- asphalt shingles deteriorate quickly
- all-wood construction weathers quickly
- shallow gable makes shed roof addition ceiling low

# LOCAL EXAMPLES

## bungalow



### Pros

- compact, four-corner floor plan
- deep porch with battered side walls provides excellent prospect and refuge
- interior space above porch uses existing structure
- white color reflects heat
- Craftsman details add character

### Cons

- west-facing porch
- asphalt shingles deteriorate quickly



### Pros

- compact, four-corner floor plan
- deep east-facing porch provides excellent prospect and refuge
- durable masonry block construction adds character
- detailing adds to appeal
- landscaping adds to appeal

### Cons

- asphalt shingles deteriorate quickly



### Pros

- compact, four-corner floor plan
- minimal glazing
- 2:1 proportion windows

### Cons

- non-elevated west-facing porch is inviting but provides little buffer to the street
- asphalt shingles deteriorate quickly

## manufactured



### Pros

- appreciates in value

### Cons

- low quality construction methods
- no porch
- not adapted for site-specificity
- fixed interior layout
- cost savings over stick-built are negligible

## mobile



### Cons

- difficult or awkward to expand or adapt
- poor interior planning
- cheap, non-durable materials
- depreciates in value
- no porch or significant buffer to street
- not adapted for site-specificity

# CONCLUSIONS

To summarize, a good, small house in Green River maximizes every aspect of its planning and construction. Its plan should be compact and divide interior space thoughtfully, eliminating wasted space devoted solely to circulation. A house that keeps its plan within four corners will be more efficient and cheaper to build, and most historic homes in Utah follow this principle.

The house should be oriented on its site so that it is protected from the hot afternoon sun coming from the west. A porch on the south side can act as a buffer between the elements and interior space, but a well-designed porch will also act as an outdoor room that provides both prospect (the ability to survey one's surroundings) and refuge for residents and an inviting entry point for visitors. Planning and use of outdoor space should also extend to use and upkeep of the yard, which should feature appropriate ground coverage for this climate that will eliminate mud and puddles during and after rainstorms. Trees and planting can also shade the house and outdoor space, significantly cutting cooling costs.

Smart construction practices, such as the use of water walls, whole house fans, and swamp coolers installed on the north side of the house will reduce ongoing utility costs by increasing the efficiency of the home. Use of climate-appropriate materials, such as metal roofing and fiber-cement siding, will increase the longevity of the house. Using reflective and light-colored materials will also increase efficiency by reducing heat gain. Appropriate insulation, eliminating the use of VOC materials, and using hardwood or tile flooring will also increase the efficiency and longevity of the home.

Attention to craft and detail can be the difference between having a functional home and having a functional and beautiful home. Proper spatial proportions can make a home compact and efficient, but they can also enhance the livability and beauty of that space. In the same way, the proportion and thoughtful placement of windows can transform an otherwise drab or claustrophobic space. Tall windows can increase the sense of height in a space, for example, and windows placed near a room corner will cast light onto the wall in

a way that increases the brightness of the space with less overall glazing. Well-crafted details can be simple but add to the appeal and sense of human scale of the house. A good house will also be sensitive to the scale, planning, and character of its surrounding neighborhood and larger environment.

Lastly, many houses in Green River feature additions or expansions. A good house will anticipate the need for more space if a family grows, and a good addition will be planned and constructed with as much thought and care as the original space.





We seek to eliminate substandard housing in Green River through a holistic approach including home repairs, new multi-family housing construction, and our design and construction of the Frontier House.

