



remote prefabricated home

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IIT masters project

spring 2012

Architecture starts when you carefully put two bricks together. There it begins.

- Ludwig Mies van der Rohe

Architecture is the art of how to waste space.

- Phillip Johnson

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*“It sometimes seems that commercial and industrial success is itself sufficient
to disqualify a prefabricated house from the status of architecture”*

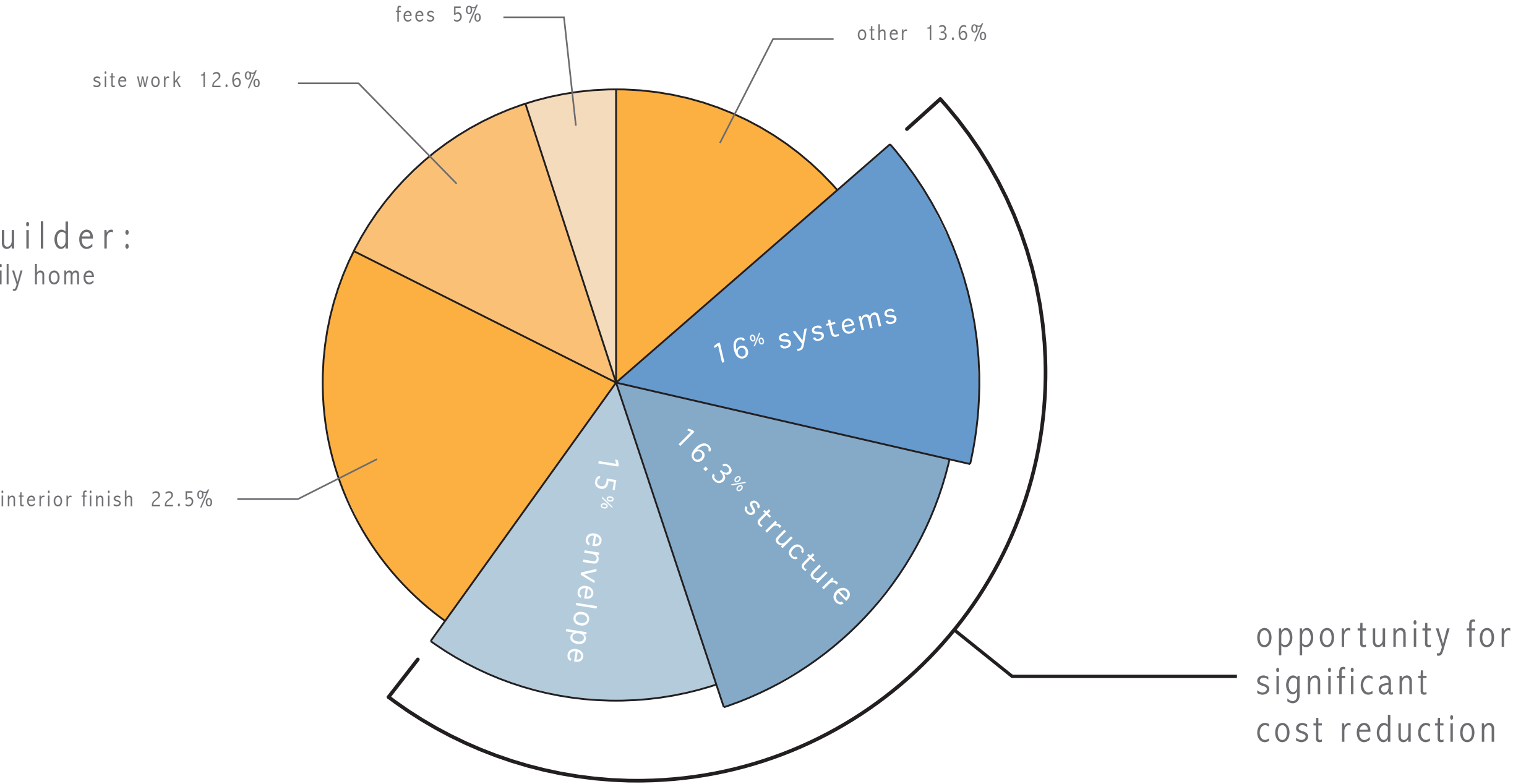
- Colin Davies, *The Prefabricated Home*

current practices

construction costs

NAHB, 2009 data

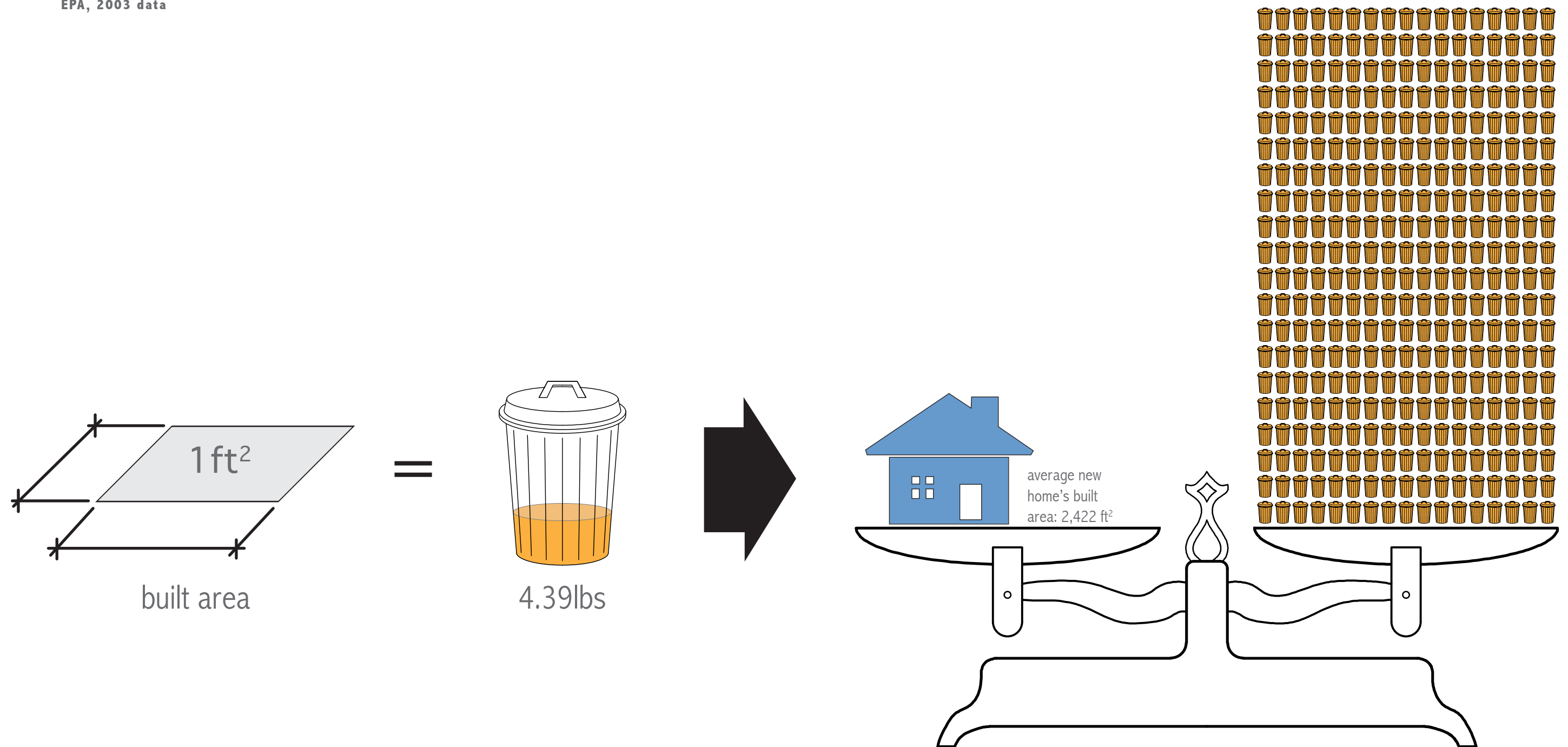
costs to builder:
typical single family home



The typical method of site-built residential construction has not changed significantly since balloon framing entered the construction scene in the late 1800’s. Ironically, this oft-used (and typically prefabricated) method of construction was readily adopted and considered a material innovation. Why? Because its simple, quick, and sometimes prefabricated construction method saved material, time, and most importantly, cost. We need to seek to replicate this leap of “innovation”, and all we need to do is exactly what its “inventor” did: adopt existing production efficiencies already in use.

construction waste

EPA, 2003 data



The American housing industry is extremely inefficient in material use and disposal. The average home constructed in the last decade was around 2000 ft², which in turn produced over 8,000 pounds of construction waste. This material waste is above and beyond the material used in what could be considered an already inefficient design typology. With construction waste landfills closing across the United States and only around 20% of construction waste being recycled care needs to be taken with the design of new homes to reduce material waste generated by and used within our homes.

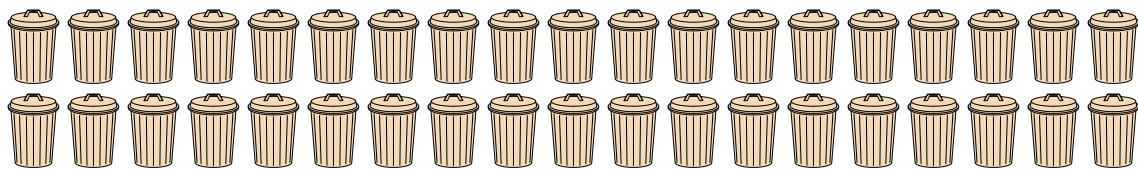
construction waste

EPA, 2003 data

residential construction



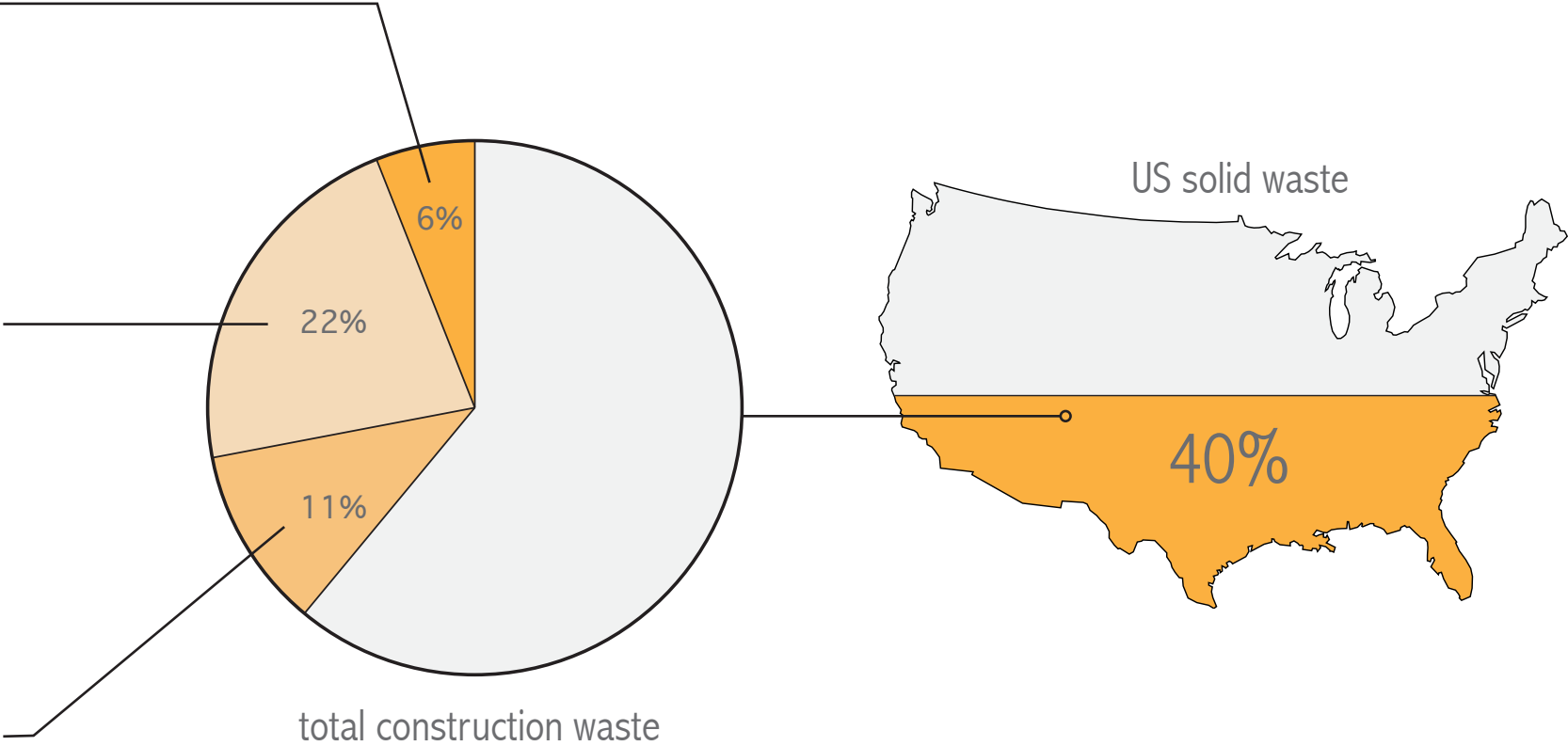
residential remodel



residential demolition



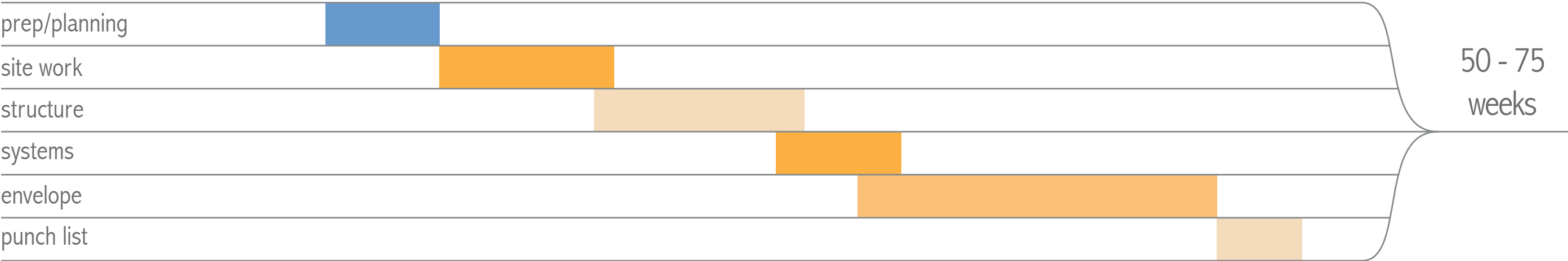
 = 1,000,000 tons of waste



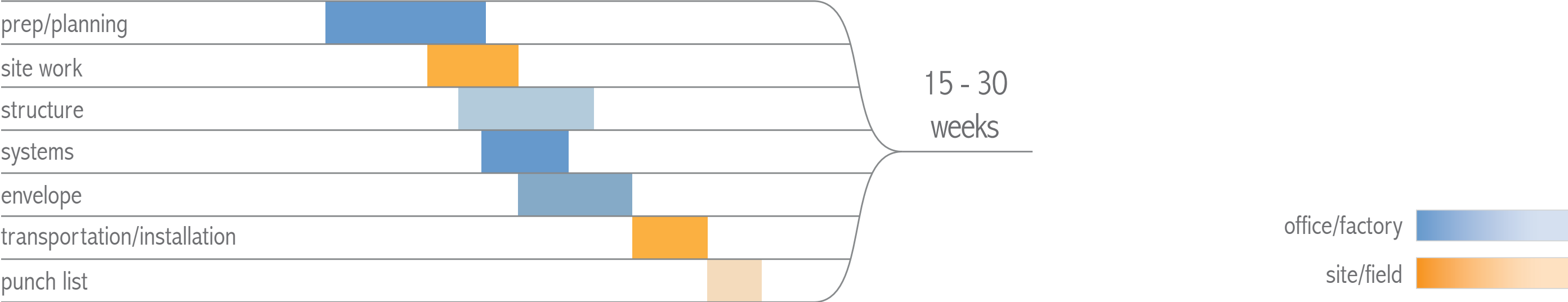
The life-cycle of new residential construction must also be considered when trying to achieve an efficient design. Reducing the amount of waste generated by residential remodel and demolition (combined over 57 million tons of waste, nearly six times that of residential construction) means confronting two realities: First, we must choose building materials that can be readily recycled. Second, we must design more efficient structures that can be assembled and disassembled into component parts to aid construction and retrofit. Prefabricating parts or all of our homes will help us achieve both of these goals.



construction time

typical single family home



manufactured/modular home



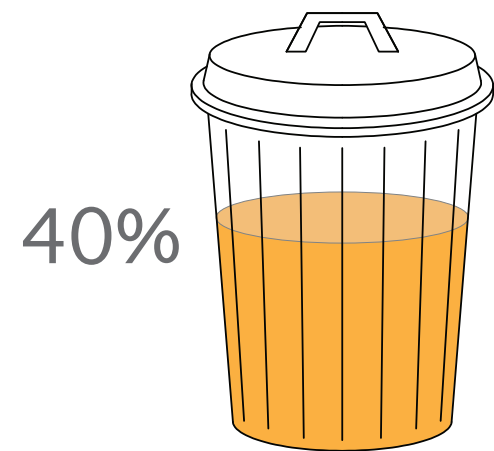
office/factory 
site/field 

Within the construction industry time is directly related to money: if you can save one you are saving the other. Prefabrication allows multiple construction phases to be completed at the same time. Critical path schedules are reduced because they are completed in a controlled, well equipped and sheltered place that becomes “critical space”. Synergies can also be developed by using one component to achieve multiple tasks. For example, systems cores can be developed as structural members, and interior wall finishes can be used as structural panels to help in the transport of modules.

looking at these statistics we can understand that one of the biggest issues facing the building industry is...

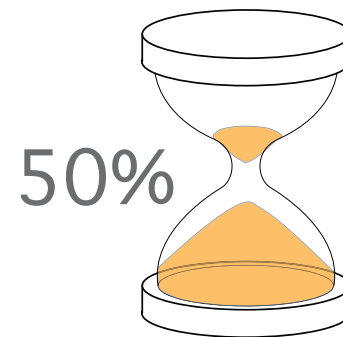
WASTE

...of material



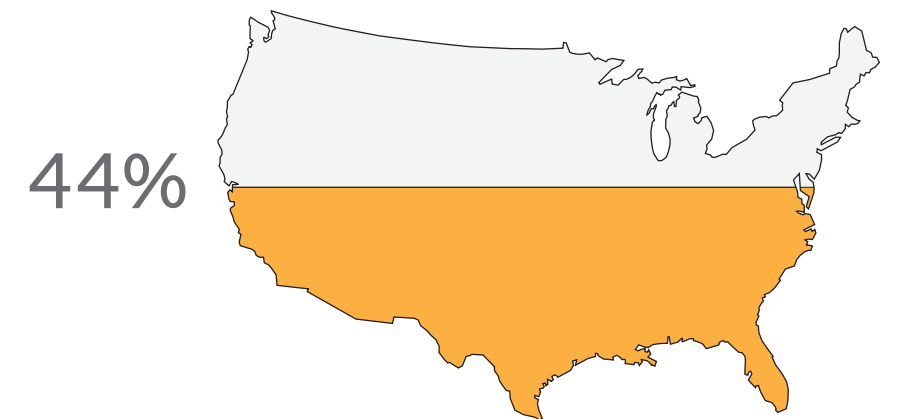
US solid waste

...of time



material handling inefficiency

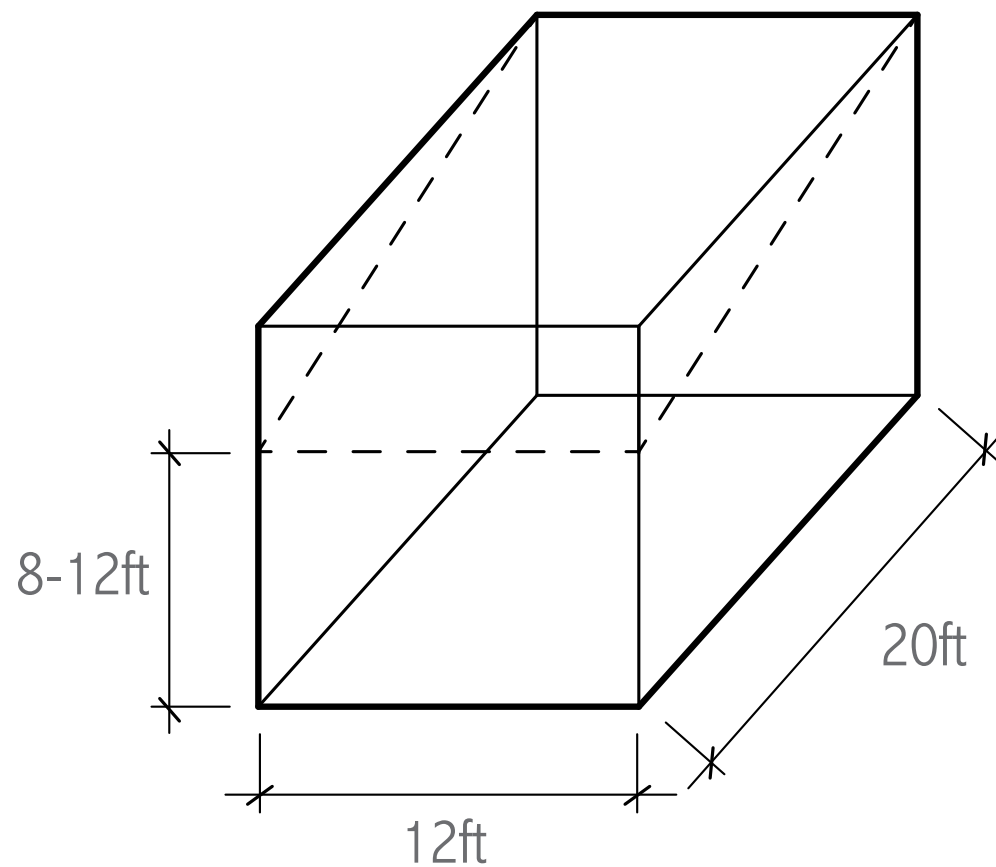
...of energy



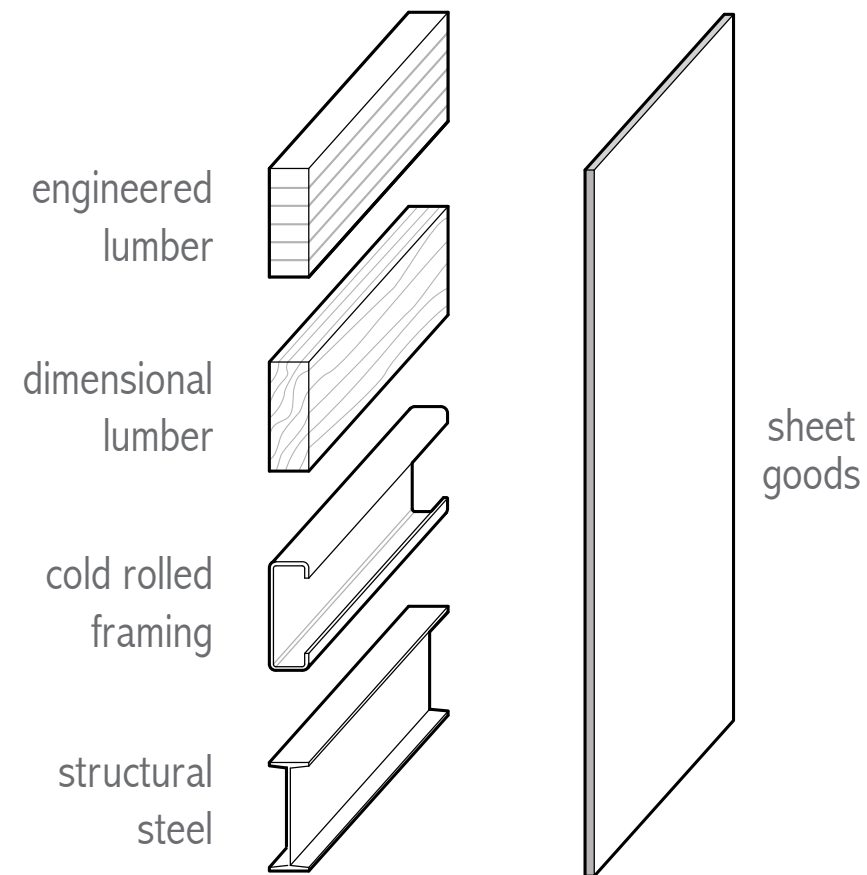
US energy consumption

We can reduce this waste with a few simple strategies:

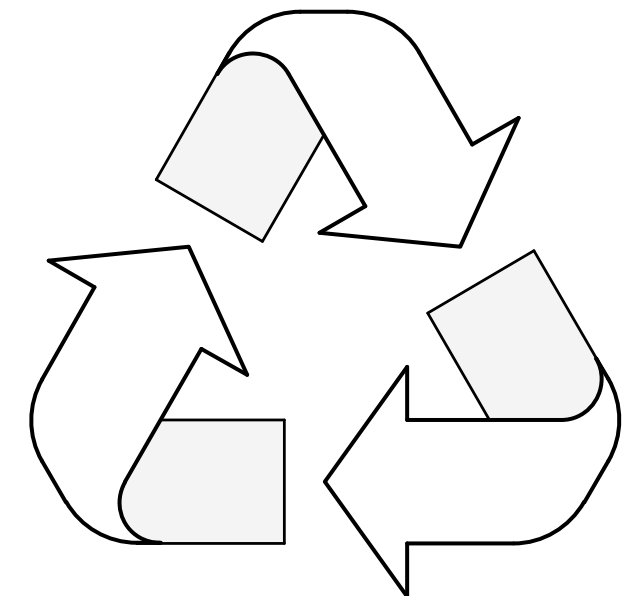
MATERIAL



organization



components

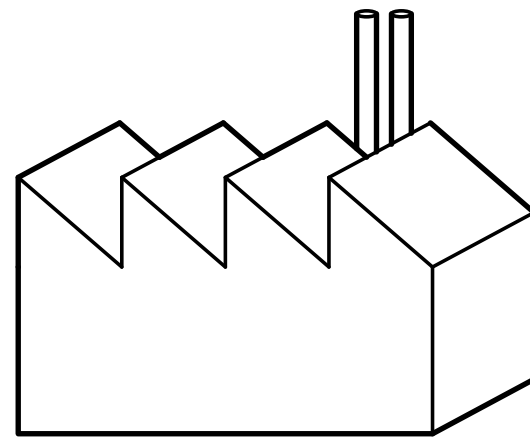
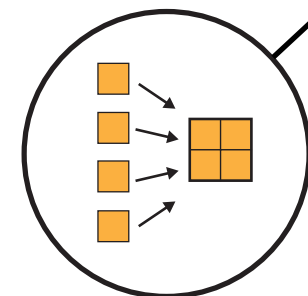
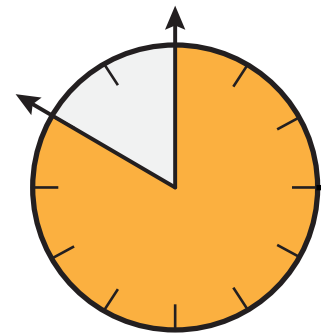
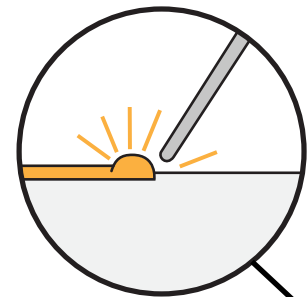


re-use

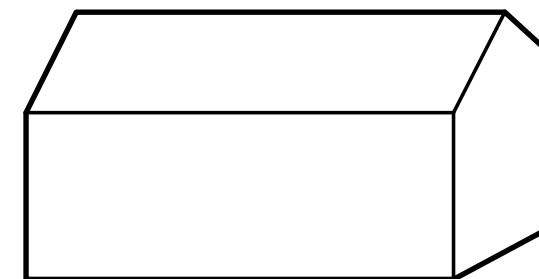
A basic way to reduce material waste is to design within a modular grid that corresponds to commonly found building material dimensions. Usually a four foot grid (or 2 foot if necessary) will accommodate almost all steel, lumber, engineered and sheet material goods. Designing with the building materials in mind should reduce unusable drops of material and the need for custom components. Specifying materials with high recycled content (such as most steel and engineered lumber) or the ability to be recycled also reduces strain on available material sources.

TIME

fabrication

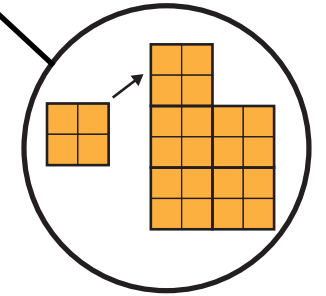
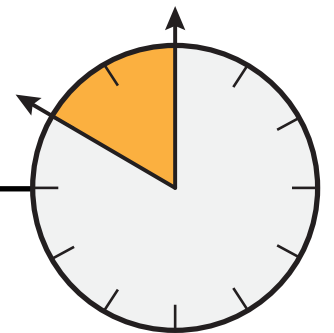
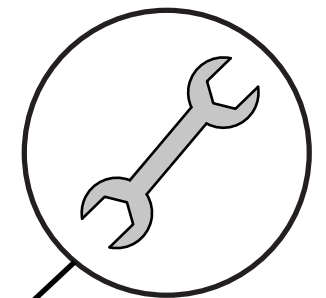


factory



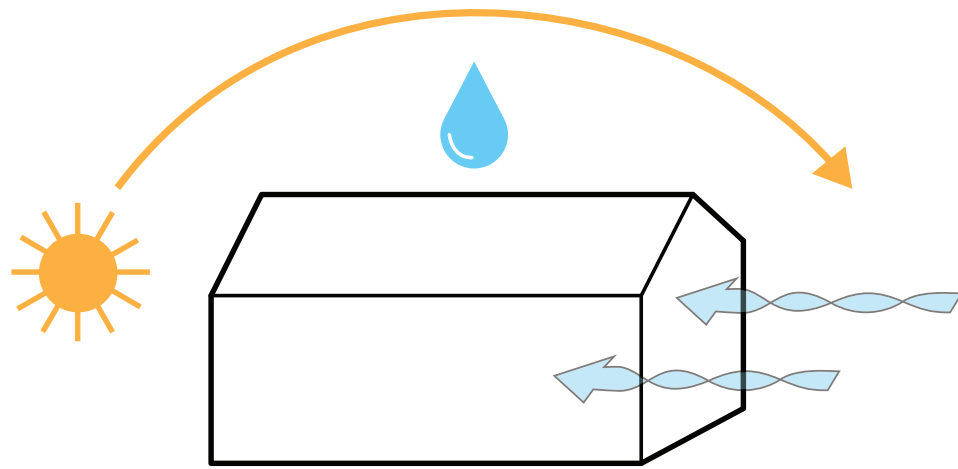
site

assembly

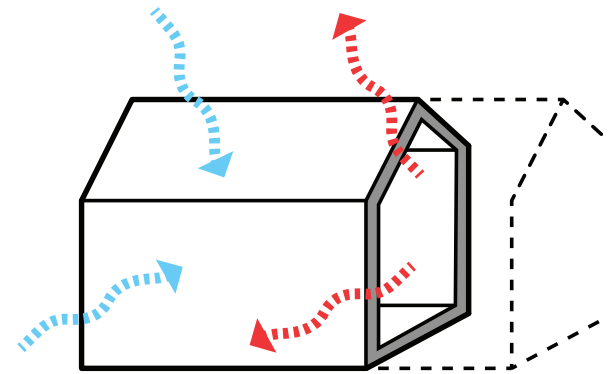


Another way to reduce material waste as well as wasted time is to accomplish as much fabrication as possible within a controlled, off-site environment. This would include labor intensive and precise activities such as welding, cutting, drilling and assembling smaller parts into larger “chunks”. Completing the work in this controlled environment also increases the quality of work while reducing labor costs and potentially unsafe or uncomfortable working conditions. The action of assembly, or bolting, screwing and joining larger chunks together, is then accomplished on site. Since the pieces being assembled already have the joints and relationships to their reciprocal pieces built into them this process of assembling is much more controlled and faster than typical on-site building activities.

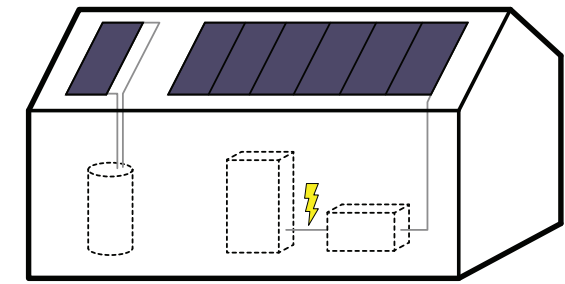
ENERGY



passive design



envelope design



efficient systems

One of the most important aspects of any building is the composition of its exterior envelope. The exterior envelope helps protect the occupants for harsh exterior conditions, as well as regulate the interior temperature and comfort. All of the gains made by smart building practices can be easily lost by the long-term wasted energy of a poor building envelope. Additionally, passive strategies of orientation and energy harvesting can help boost the performance of a building envelope and reduce the need for supplemental active systems, thereby reducing the long term impact of the building.

these strategies can have an enormous impact on the residential construction.
Consider recent market data:

housing production

US Census Bureau, 2009 data

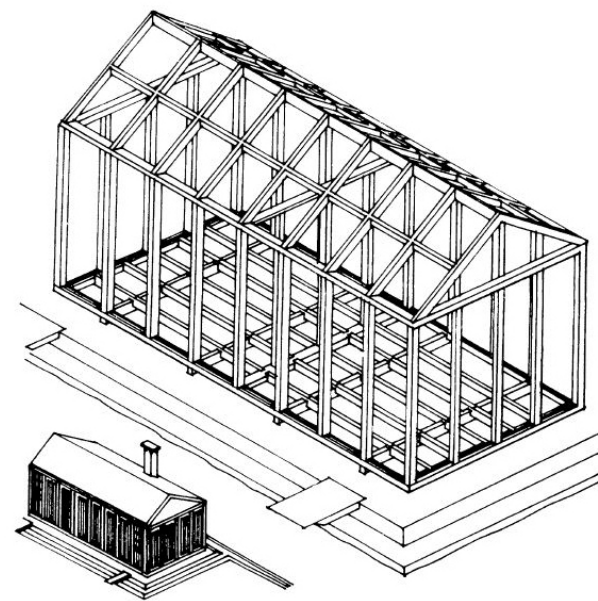


Higher cost, higher production, but higher customization. Typically wasteful with the amount of space built and poor on-site building practices.

the great divide

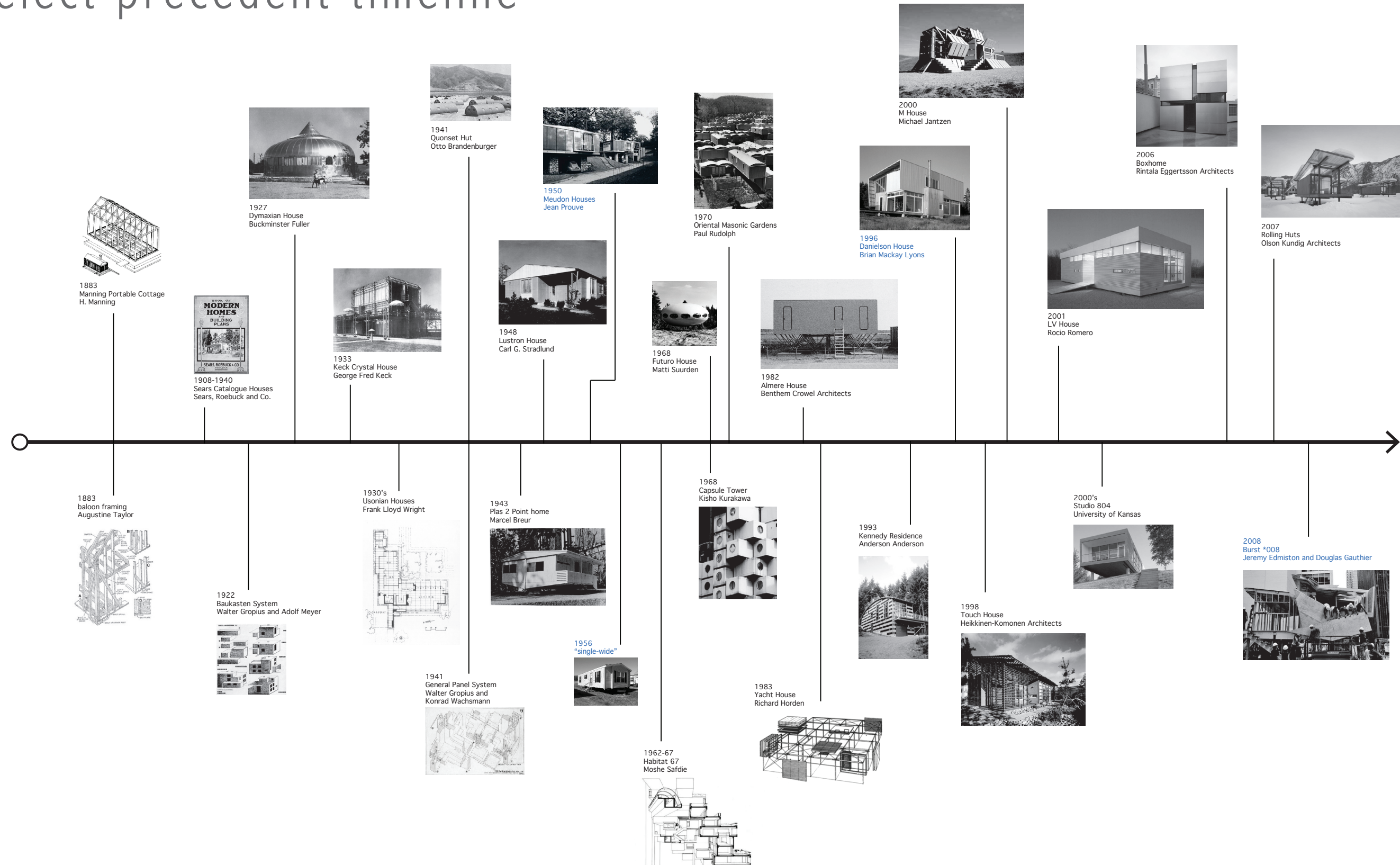
Lower cost through prefabrication, but much lower production. Typically poor design quality and considered semi-permanent.

Systematic changes in how we approach design and construction can have enormous impact based on the amount of homes that continue to be built. Improving the overall quality and performance of homes is an ethical and economic imperative for the future of architecture.



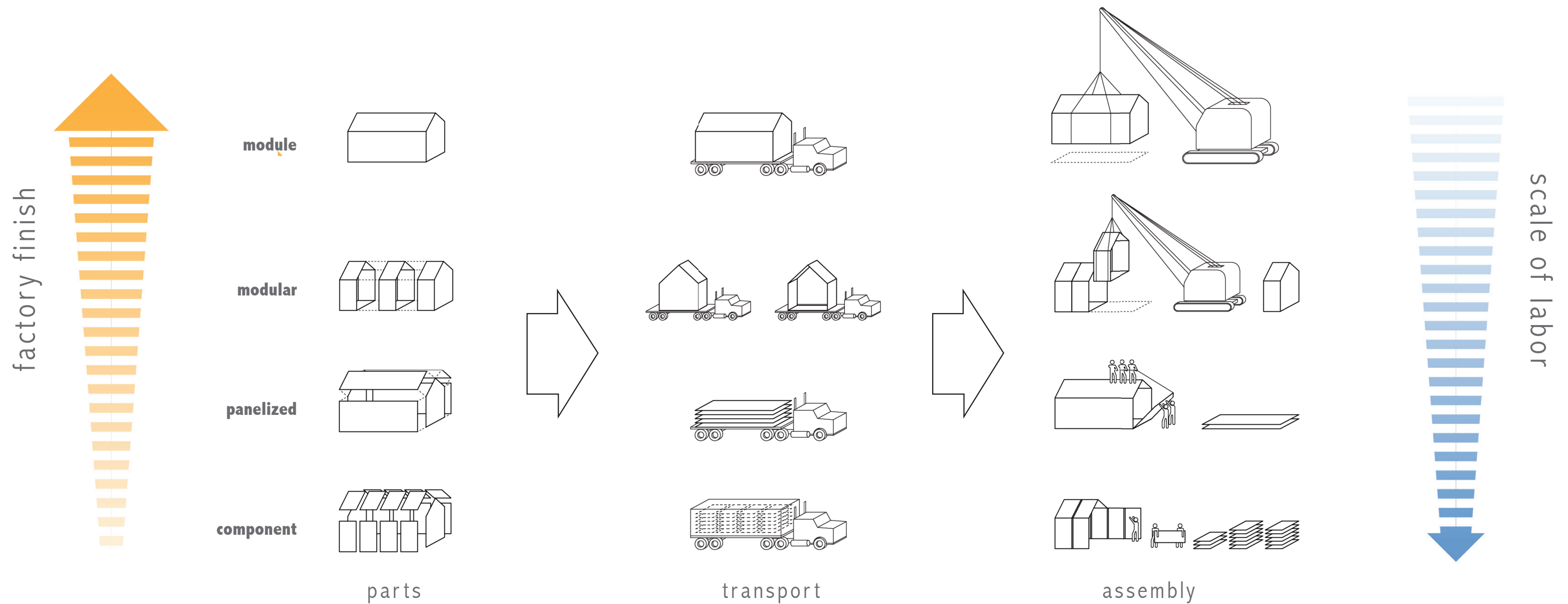
precedents

select precedent timeline



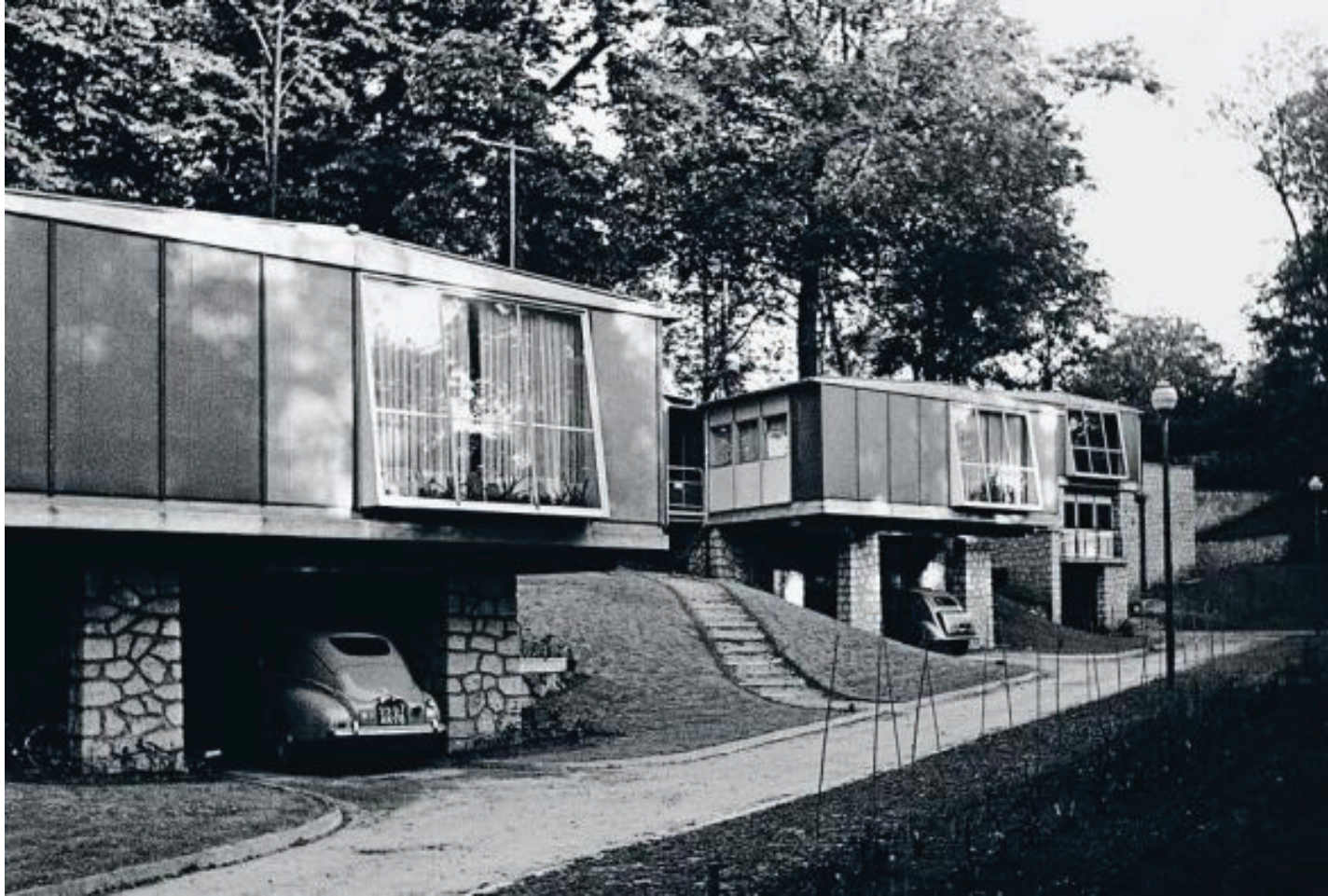
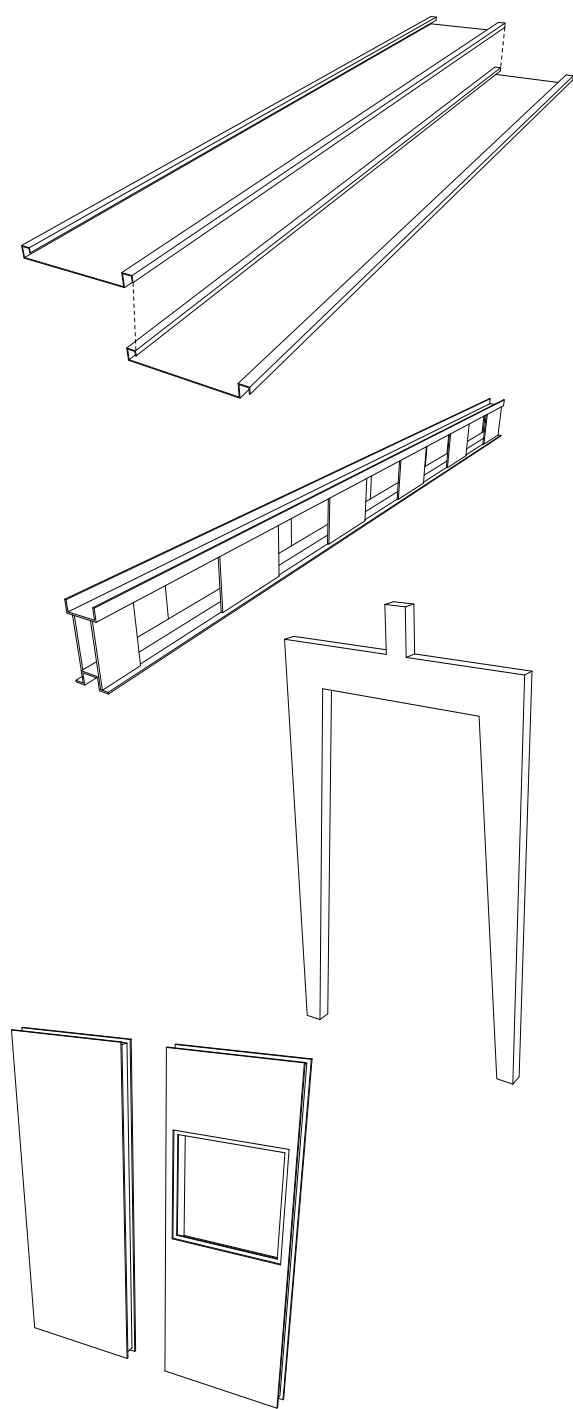
Residential architecture has a rich history of prefabrication technologies and a number of different organizational and material strategies used to typically achieve light, economical and quickly constructed buildings. There is much to gain from a review of these diverse projects, and I have analyzed a select few in depth as benchmarks for this project.

prefabrication typologies

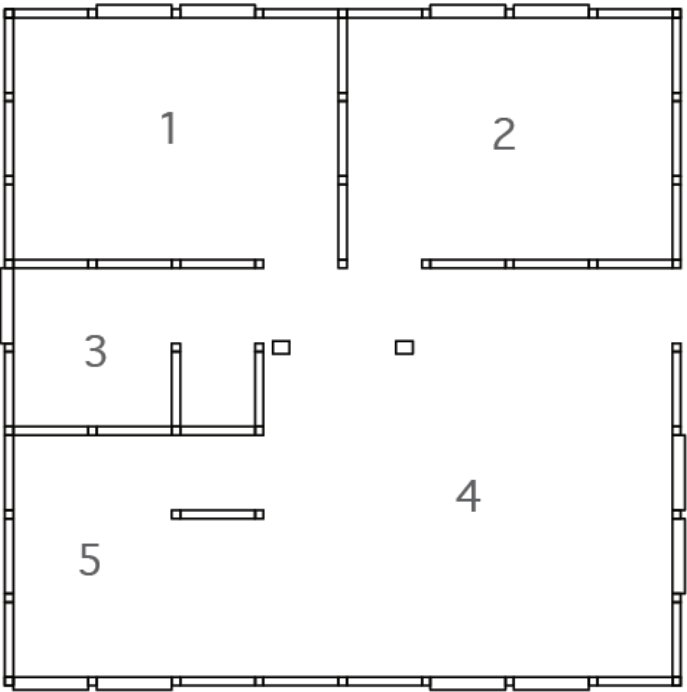


Many strategies and typologies exist within the prefabrication industry. These include single modules, modular (multiple modules), panelized and component organizations. Each system has inherent benefits and costs, but generally an inverse relationship exists between the amount of “factory finish” and the scale (not the *amount*) of on-site labor needed to install the prefabricated parts.

meudon standard houses jean prouvé 1949-1952

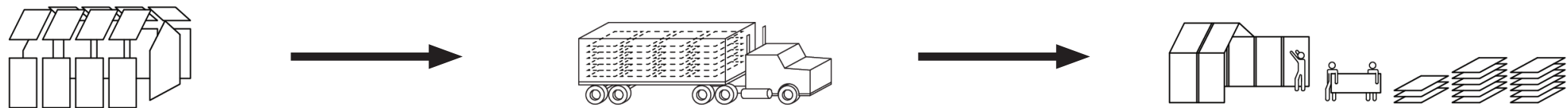


The Meudon “Standard Houses” were commissioned by the french government to help alleviate the postwar housing crisis in France. Jean Prouvé was chosen to develop the housing prototype based on his past experience with prefabricated residential buildings and his engineering background. Prouvé’s quest for simple, light construction solutions are evident in the houses weltd sheet steel primary structure and modular aluminum sandwich component panels which comprised the building envelope. The entire structure was designed to be constructed by two people in a few days. The modular nature of the wall panels allowed for different “programs” within the wall (door, punched opening, window wall and opaque panels) and replacement if damaged. 25 prototypes were commissioned, although after contract difficulties only 10 were built. However, many still serve as active homes to this day and stand as a testament to the possibility and durability of prefabricated home design.



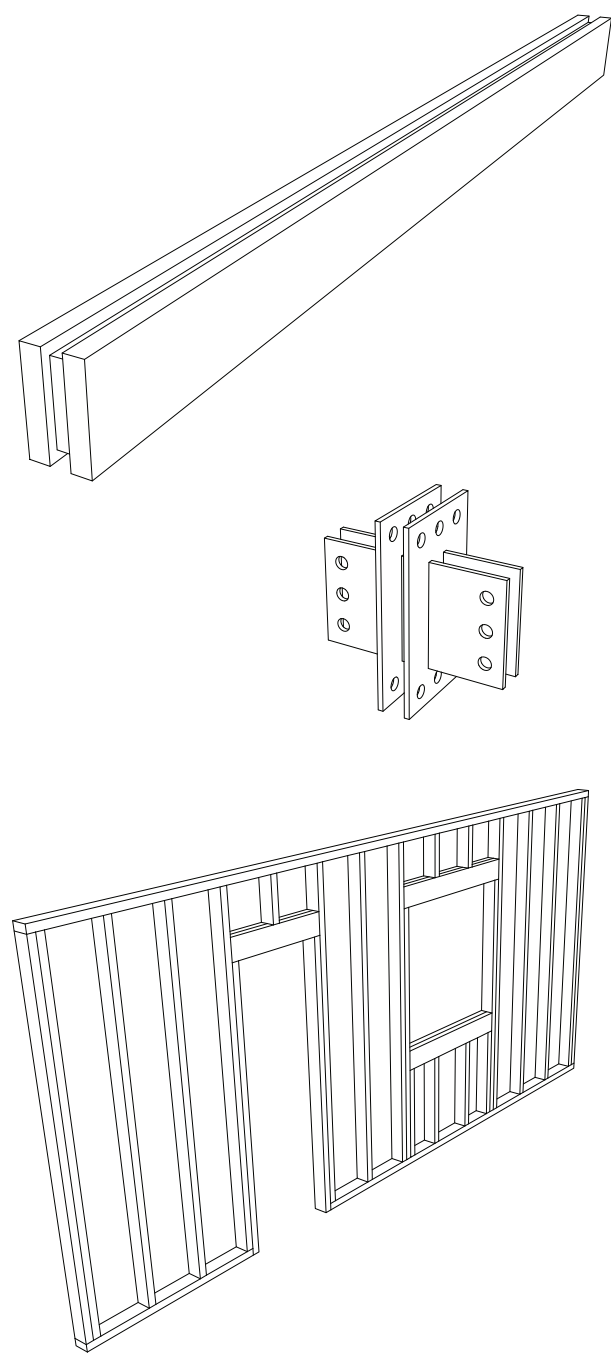
program/floor area

1. bedroom:	122 ft ²
2. bedroom:	122 ft ²
3. bathroom:	58 ft ²
4. living/dining:	206 ft ²
5. kitchen:	98 ft ²
net:	606 ft ²
gross:	706 ft ²
net to gross:	85%

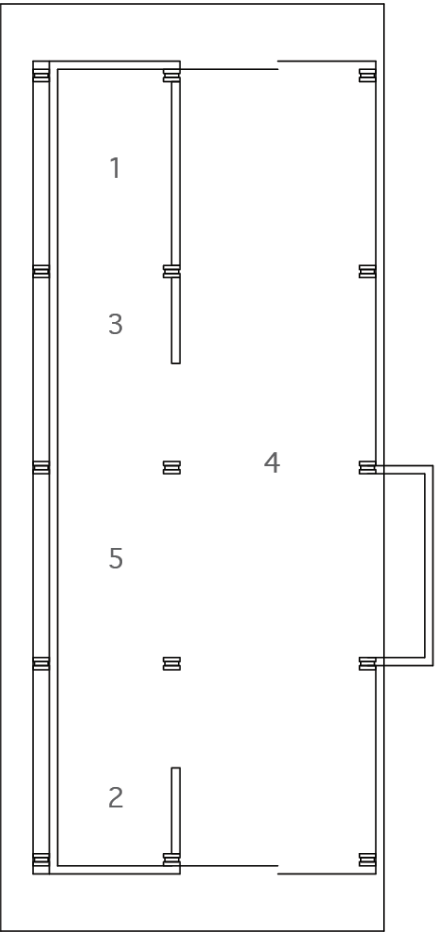


danielson house

brian mackay lyons 1996-1998

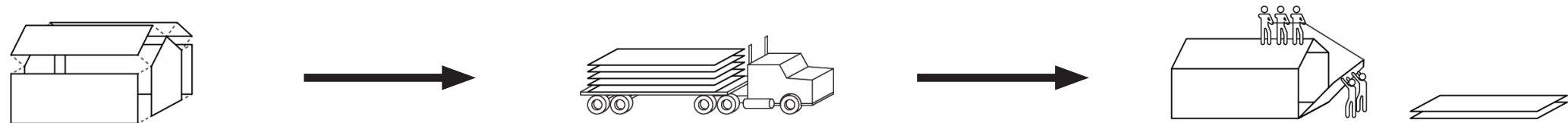


The Danielson House is located in Nova Scotia on an island with an overlook to the sea. Due to the remote location of the site a majority of the simple lean-to building was prefabricated in Halifax. The house was also phased to accommodate the modest budget (under \$100,000.00) and the clients time schedule. The house is organized around a spine of service space that can be closed when not in use, and a large vaulted multi-use living space that can also be opened to the exterior deck. The harsh winter climate necessitated a strategy to protect the light structure, so local materials along with operable “eyelids” that can shield the glazed portions of the building. Although it is a “custom” home the prefabrication strategies and simple organization demonstrably kept construction cost low and could be implements in a series of houses in the future.

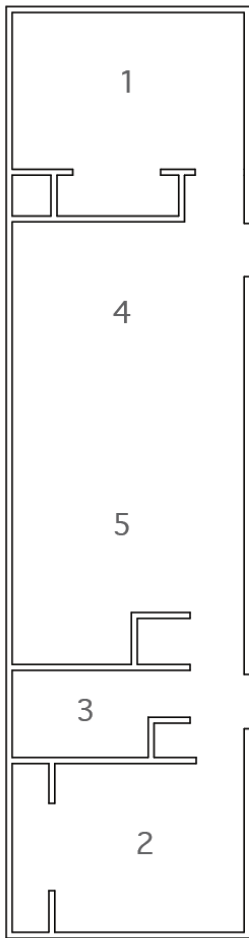
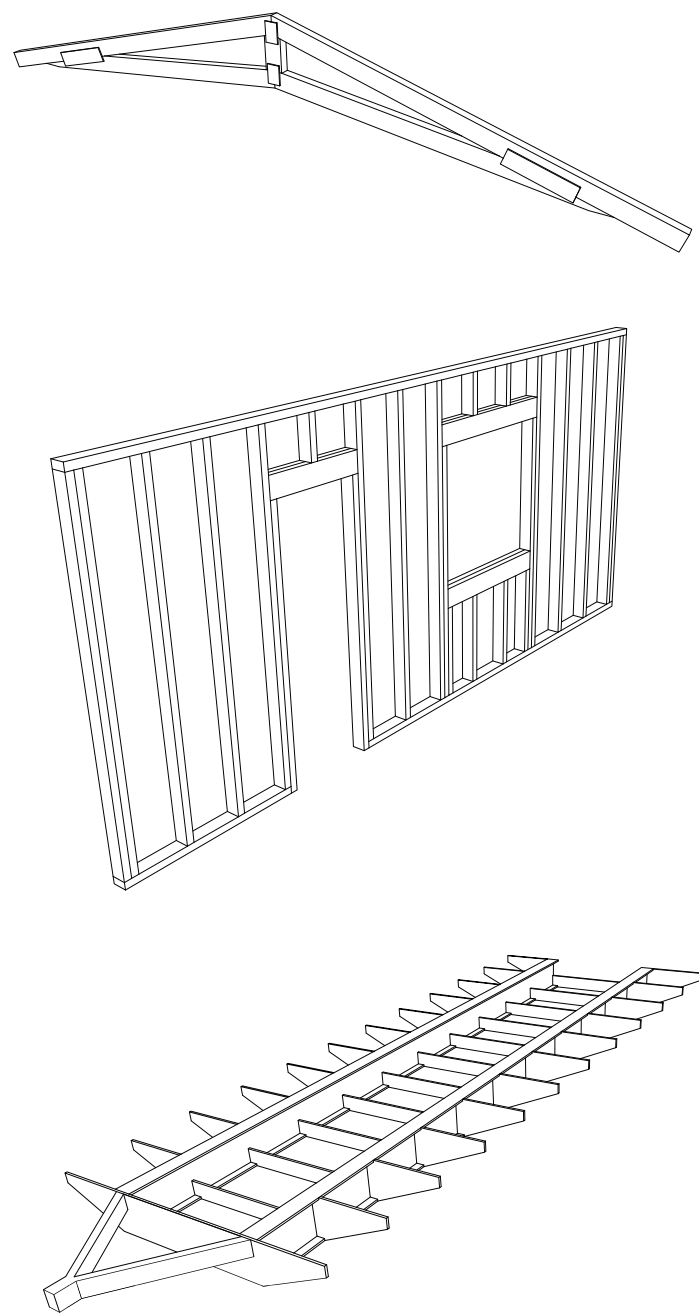


program/floor area

1. storage:	84 ft ²
2. storage:	38 ft ²
3. bathroom:	24 ft ²
4. living/dining:	618 ft ²
5. kitchen:	174 ft ²
sleeping loft:	340 ft ²
net:	1278 ft ²
gross:	1538 ft ²
net to gross:	83%



the laredo II palm harbor homes

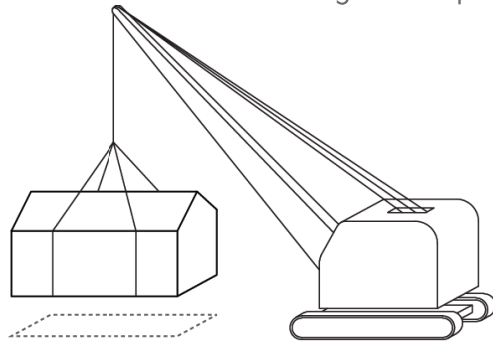
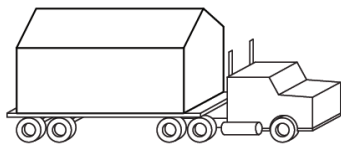
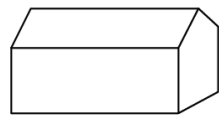


The Laredo II is an example of a typical “single wide” prefabricated, balloon framed home that has become extremely successful as a cheap, fast housing solution throughout the country. Considered a vehicle under federal law, these homes are permanently attached to a rolling chassis that serves as a means of transport and a virtual foundation. These structures are somewhat configurable to clients wants with a limited set of “modular” off the shelf components. They also tend to mimic “traditional” American housing styles with pitched roofs, eaves, gables, and fake dormers. Although often considered “cheap” in construction they none the less remain widely implemented and continue to retain a significant portion of the American housing industry.

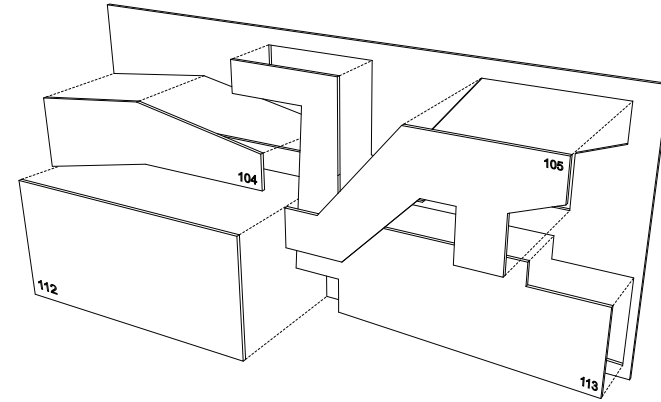
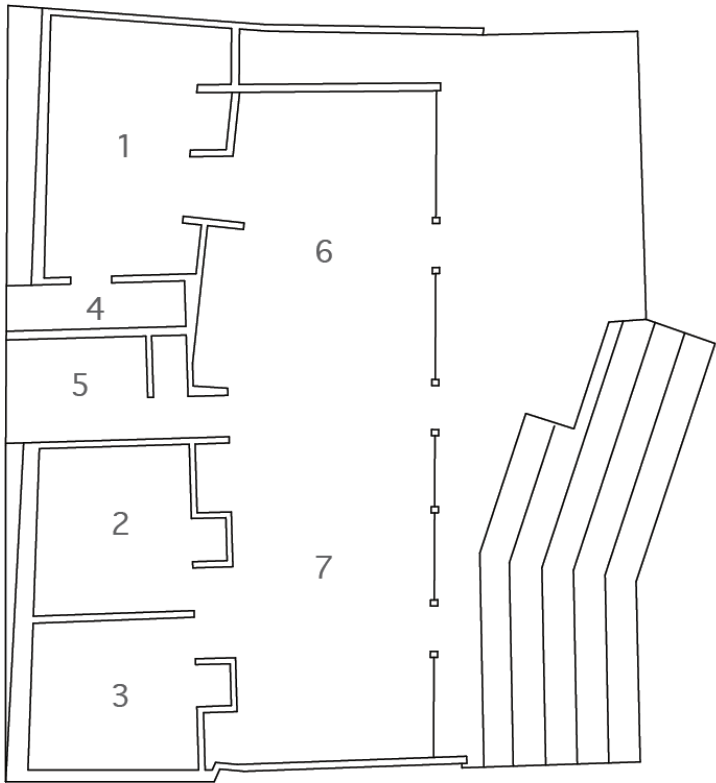
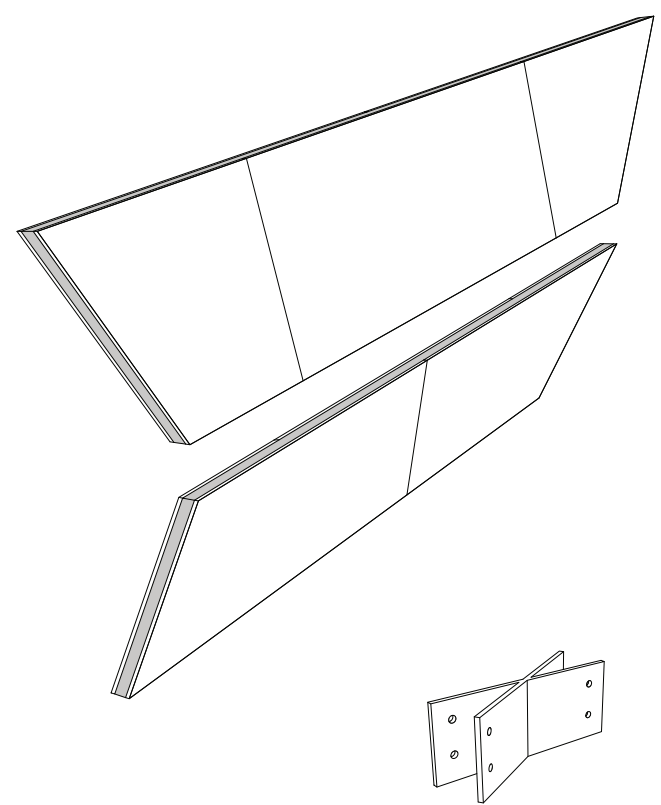
program/floor area

- | | |
|-------------------|---------------------|
| 1. bedroom: | 114 ft ² |
| 2. bedroom: | 100 ft ² |
| 3. bathroom: | 44 ft ² |
| 4. living/dining: | 160 ft ² |
| 5. kitchen: | 144 ft ² |

net:	562 ft ²
gross:	714 ft ²
net to gross:	78%



burst *008 jeremy edmiston and douglas gauthier

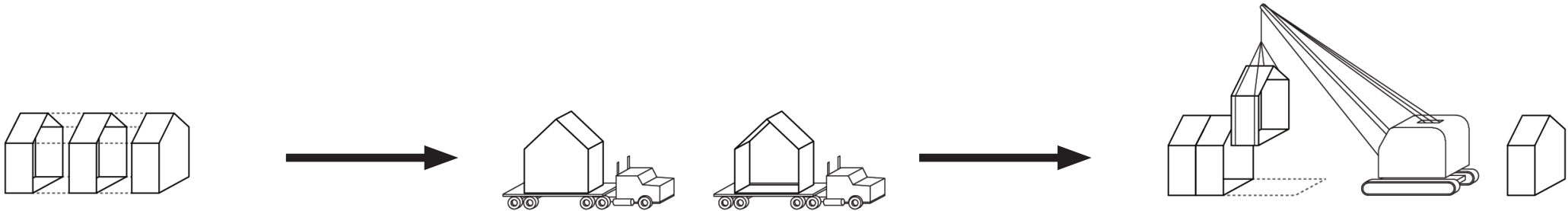


Burst *008 is the second iteration of a design strategy pioneered by architects Jeremy Edmiston and Douglas Gauthier. It uses custom algorithms to generate a series of numbered, laser cut pieces form standard 4ft. x 8ft. pieces of laminated plywood. These pieces are joined in a lemela-like pattern with the use of metal “X” brackets and constitute the primary structure of the house. SIPs panels are used for sheer walls. The CAD-CAM technology used to generate the drawings and actual pieces for the house can be used to generate new and different iterations of the same house when different parameters (i.e., number of bedrooms, floor area, desired glazed openings) are fed into the program. In this way the architects designed a flexible system for prefabrication rather than specific pieces, which allows a much more dynamic and customized final product.

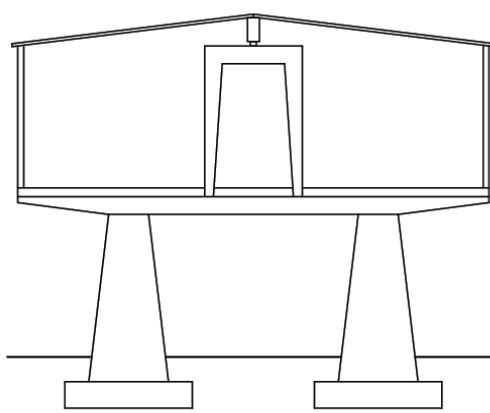
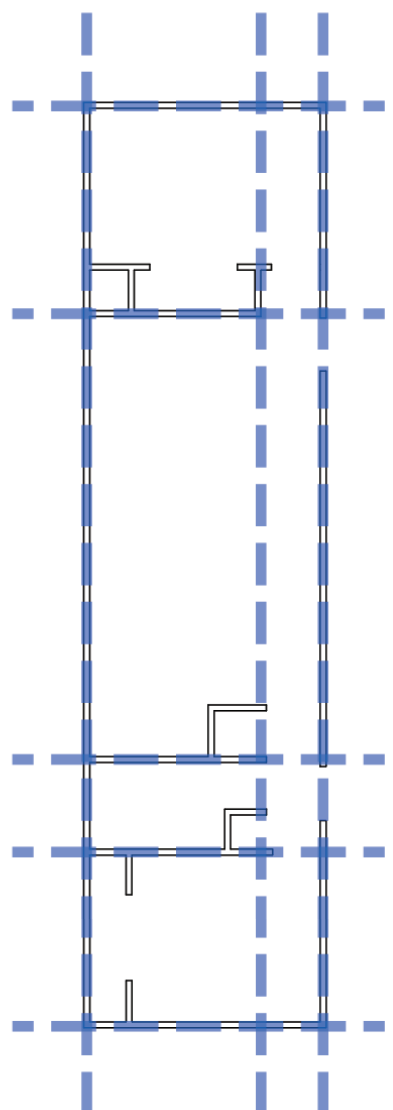
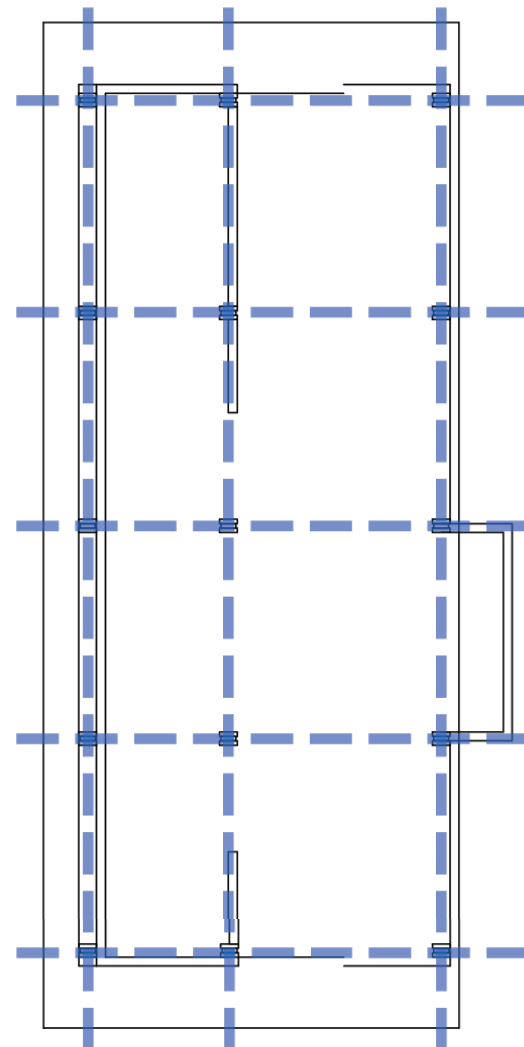
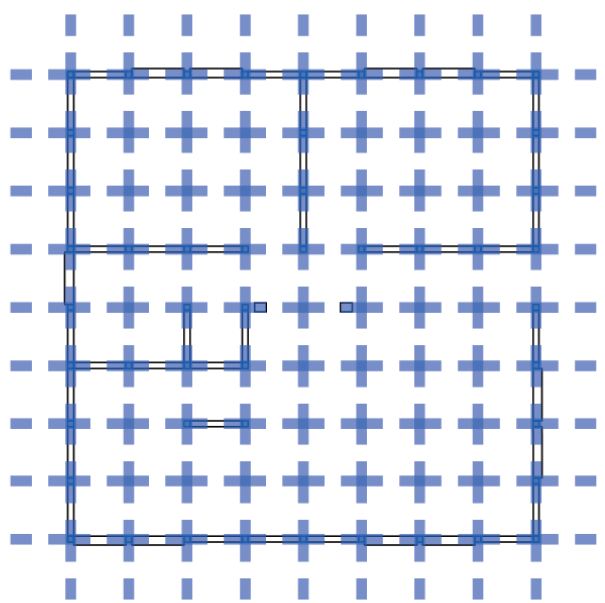
program/floor area

1. bedroom:	116 ft ²
2. bedroom:	78 ft ²
3. bedroom:	74 ft ²
4. bathroom:	24 ft ²
5. bathroom:	54 ft ²
6. kitchen:	168 ft ²
7. living:	218 ft ²

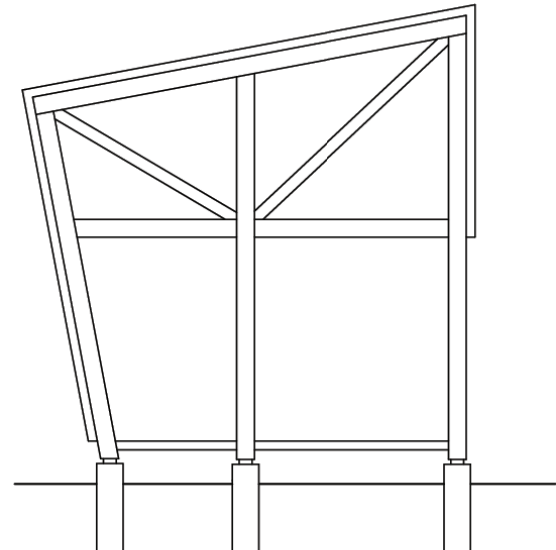
net:	732 ft ²
gross:	964 ft ²
net to gross:	76%



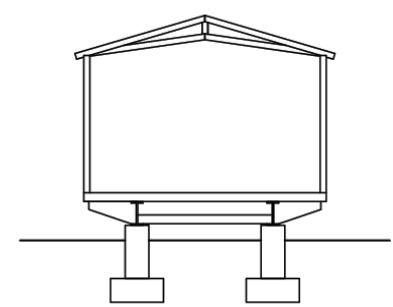
organizing lines



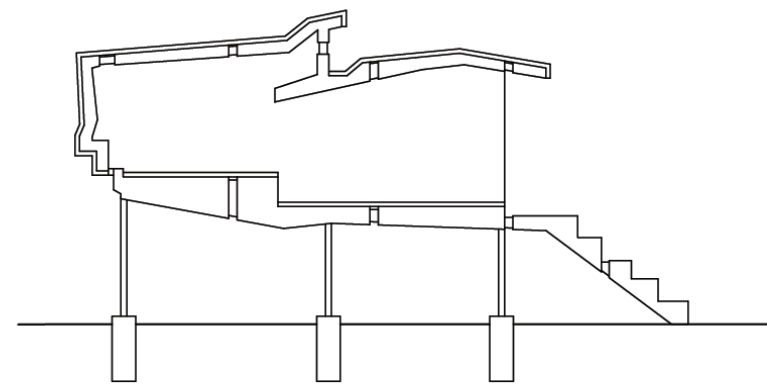
moudon houses



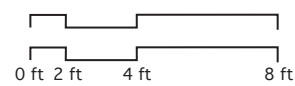
danielson house



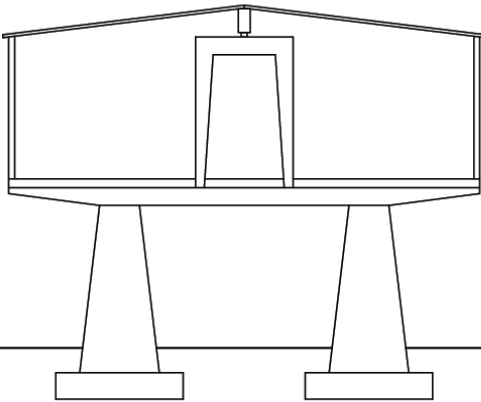
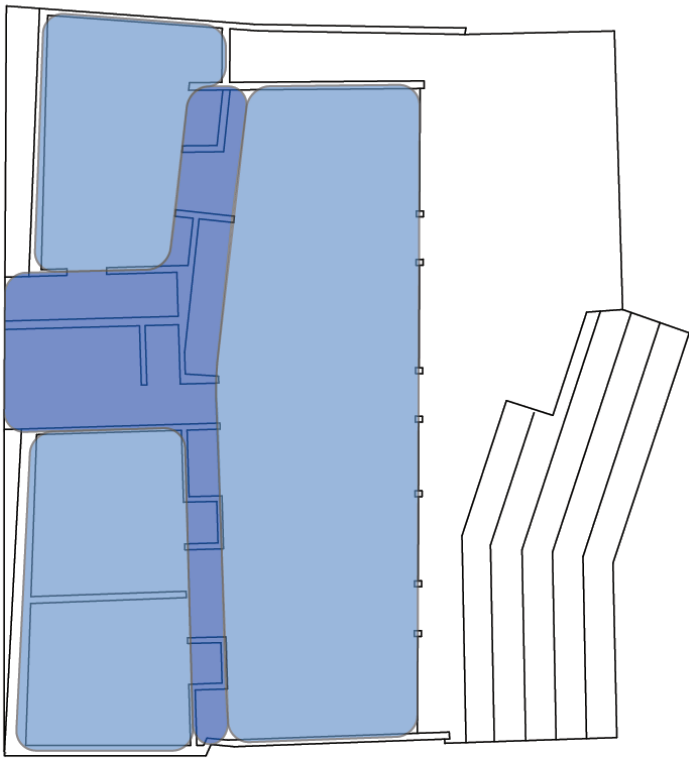
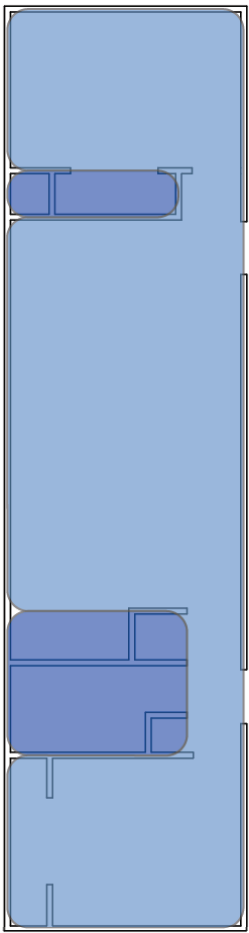
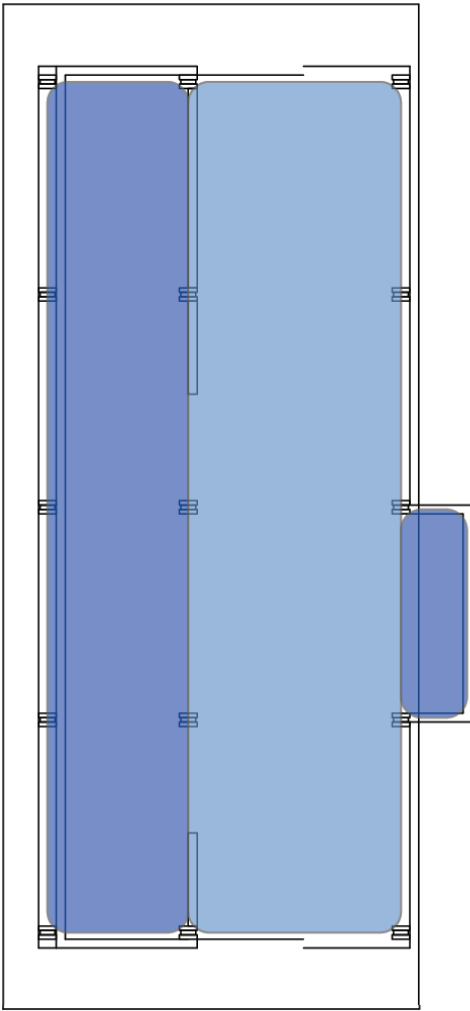
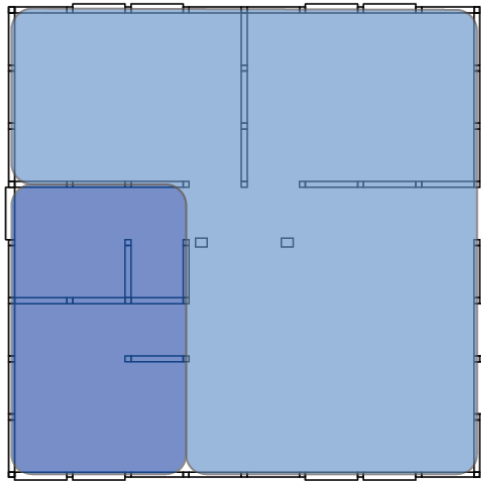
laredo II



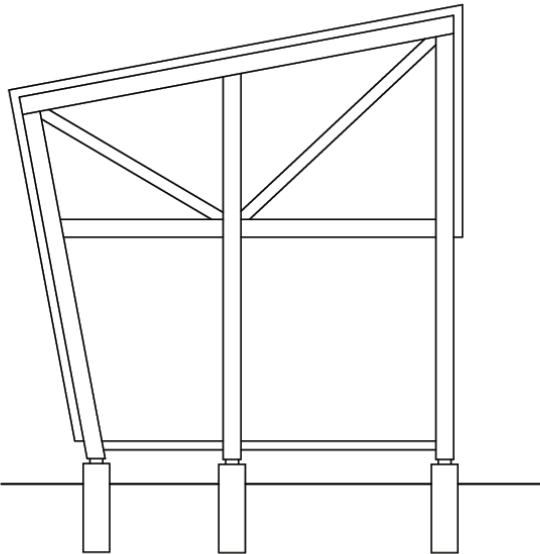
burst *008



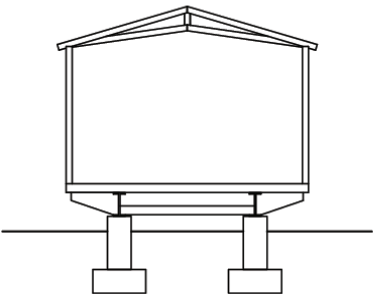
servant/served



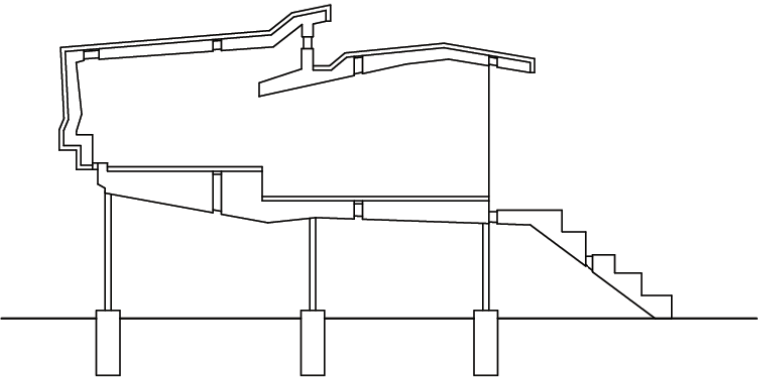
moudon houses



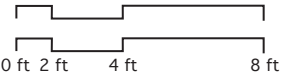
danielson house



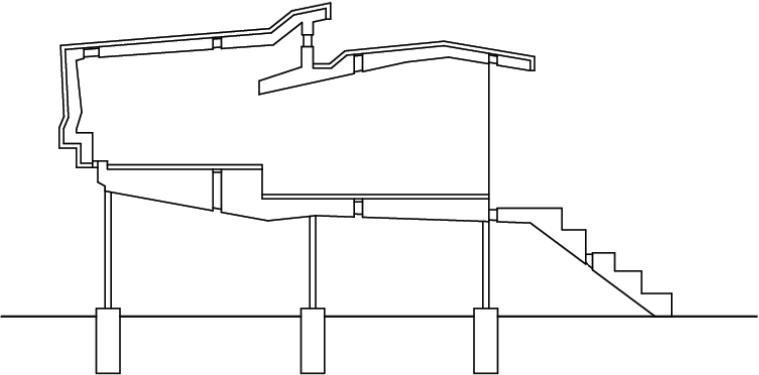
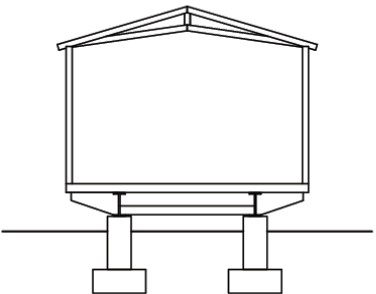
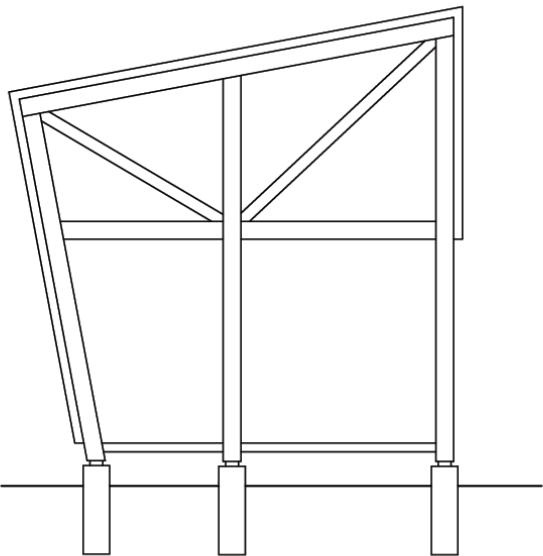
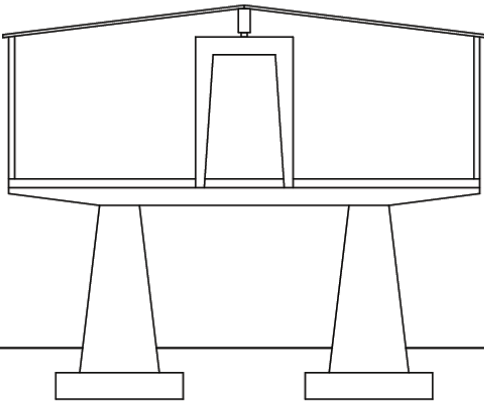
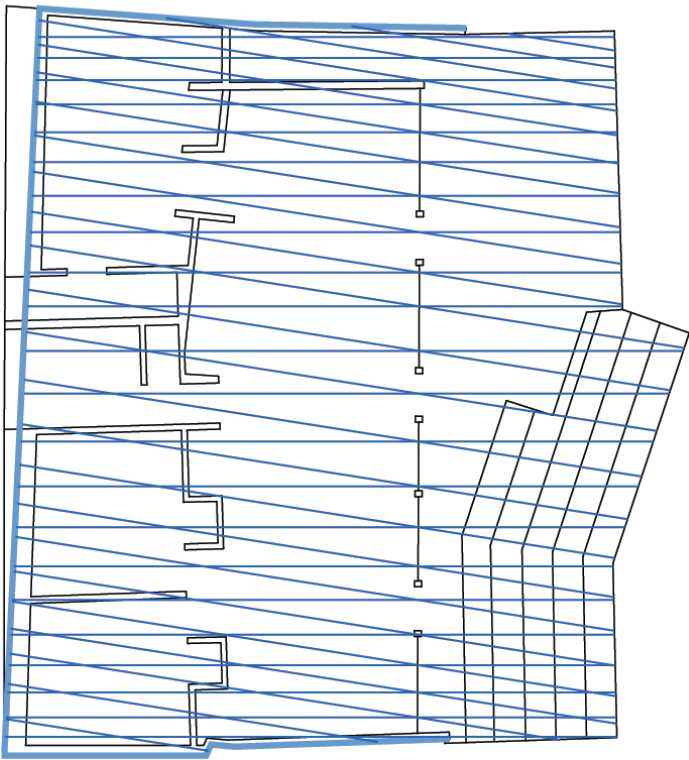
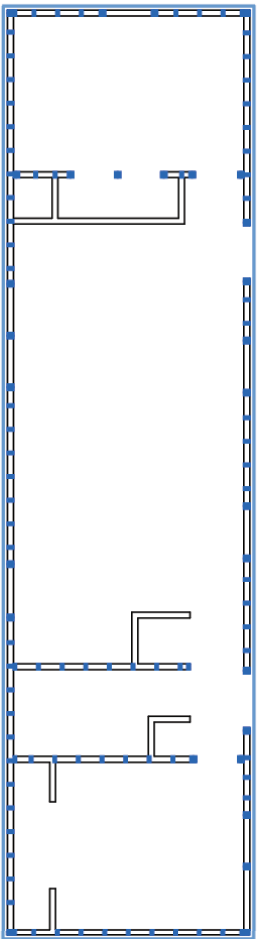
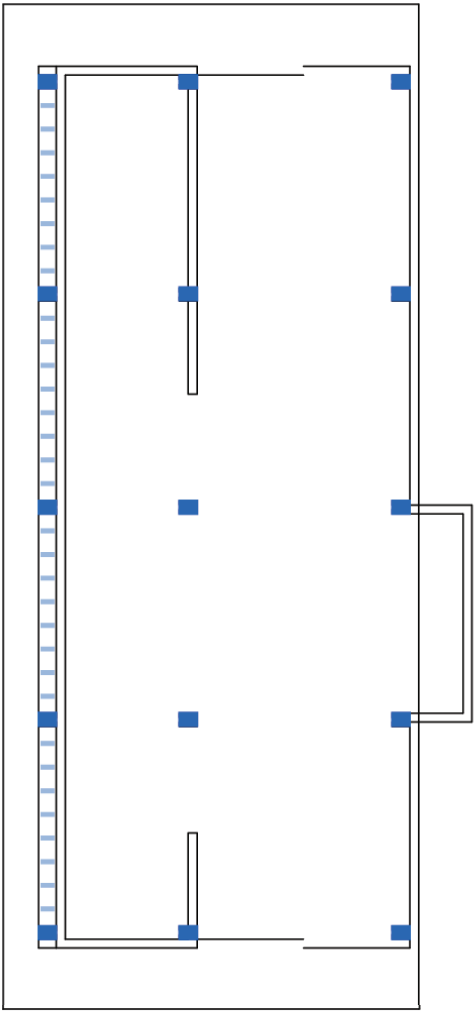
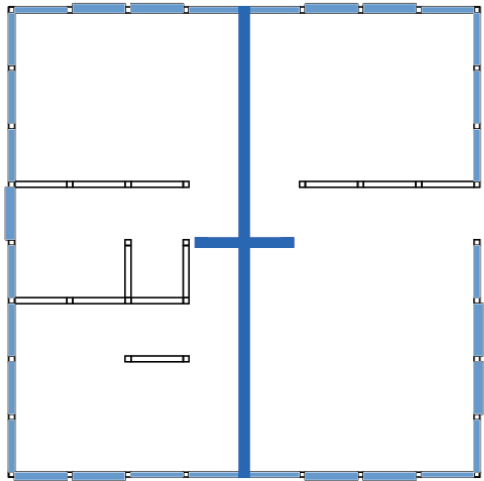
laredo II



burst *008



structure



moudon houses

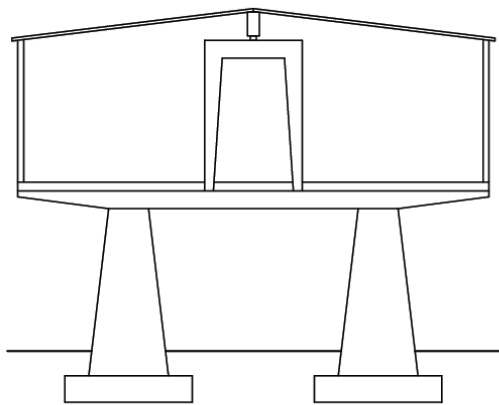
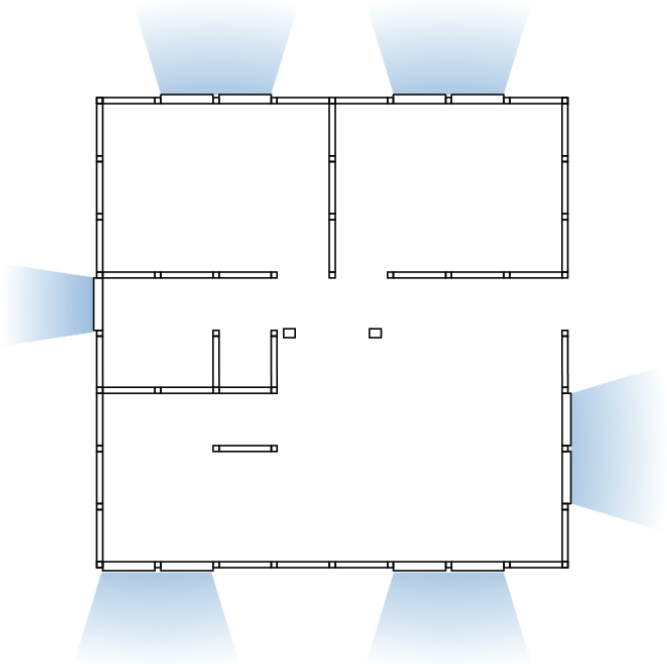
danielson house

laredo II

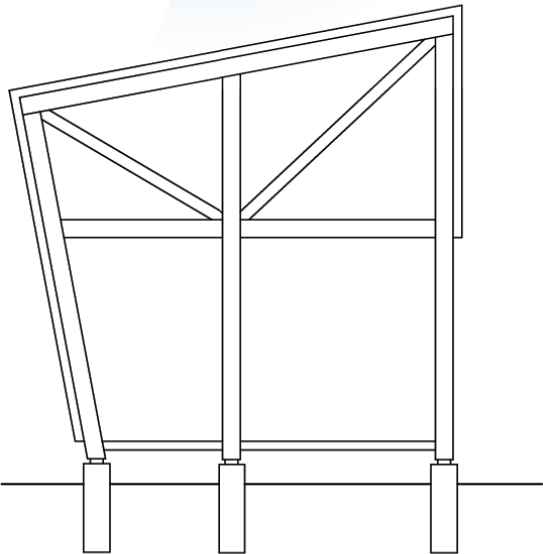
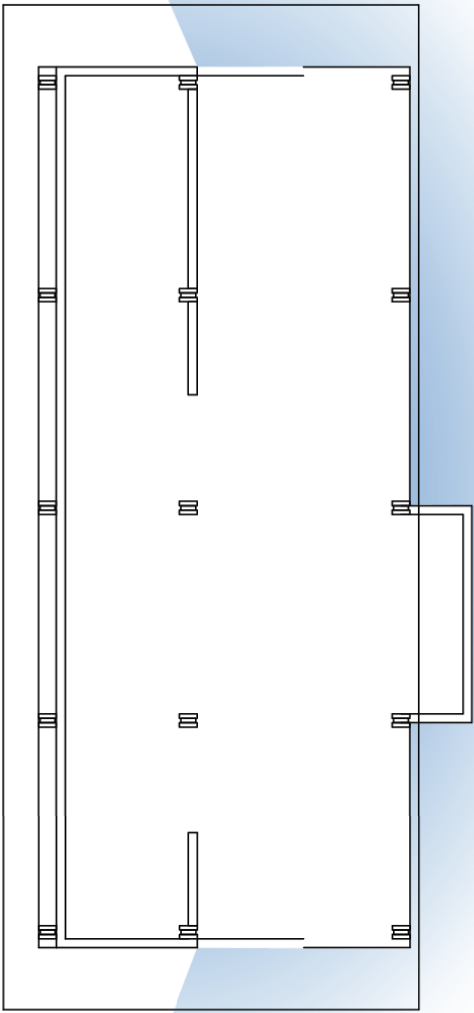
burst *008

0 ft 2 ft 4 ft 8 ft

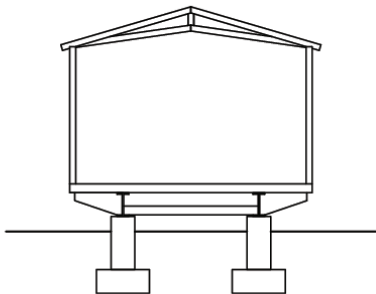
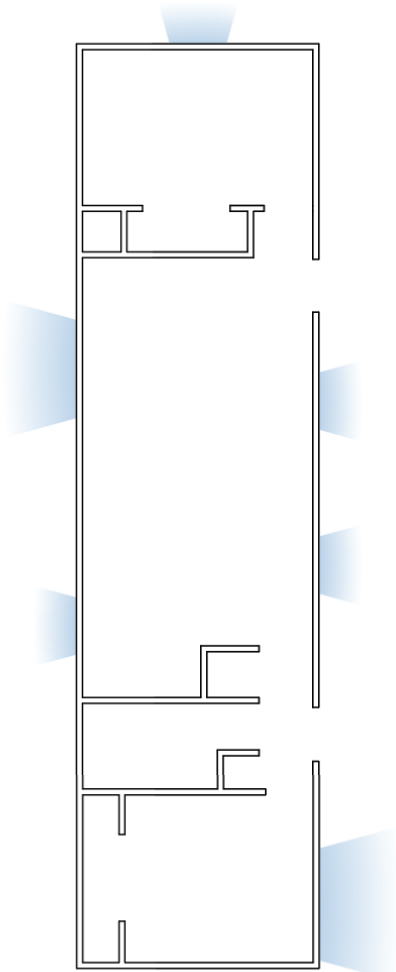
view



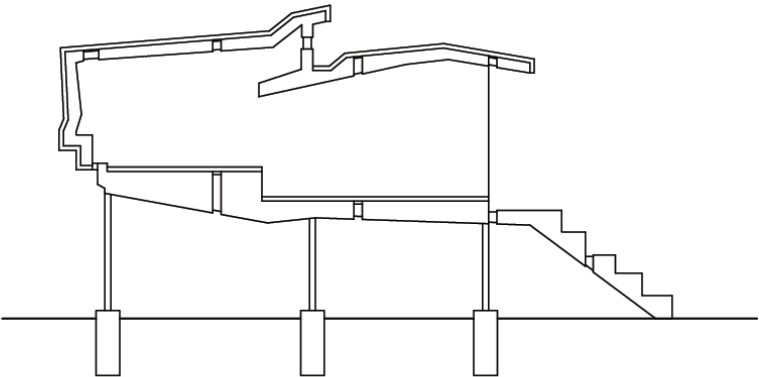
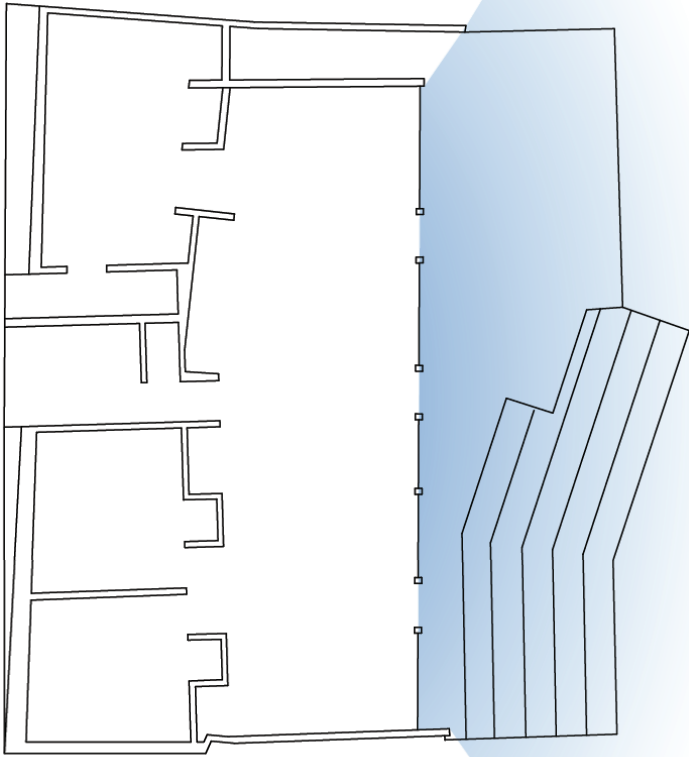
moudon houses



danielson house

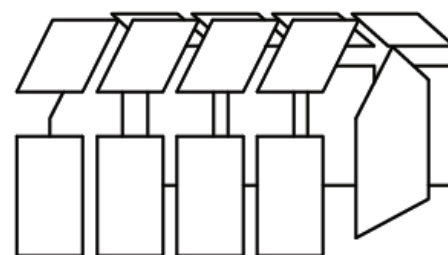


laredo II



burst *008

0 ft 2 ft 4 ft 8 ft



a strategic solution

the strategy

prefabrication

Prefabrication holds a number of advantages for the housing industry. The production process benefits from being climate controlled, weather proofed and within close proximity to resources. Additionally, prefabrication provides a greater amount of control over the construction process.

Prefabrication allows unforeseen issues that occur during construction (an inevitability with a “new” process and a young designer) to be resolved before they are encountered on site, saving time, money, and material.

Additionally, using prefabrication allows the pieces of the project to be tailored to be constructed by individuals with a moderate skill level, but more importantly without heavy machinery that would need to be transported to a remote location. Maximizing labor efficiency is a key goal of this project, and prefabrication is the method to accomplish this.

The realities of the modern construction industry and growing resource scarcity demand a prefabricated solution for modern homes.

integration

The best way to accomplish the many goals of this project is to integrate all available tools into the design strategy.

To achieve Net Zero both passive and active energy strategies will need to be implemented. This includes the latest in energy producing technologies as well as traditional methods of building organization and orientation based on site conditions.

Waste reduction can also be better accomplished by integrating new technologies and methods of production. Using parametric modeling and CAD-CAM production waste can be reduced by optimizing material use and using standard construction materials in unique ways.

Additionally, looking at past examples of prefabrication for lessons on organization, production, materiality and construction will produce the best solution. The final product of this strategy cannot be beholden to a past style or fad, but look to use all available resources to synthesize an efficient, beautiful home. None the less, a product that is “accepted by the public” is necessary to the success of this project.

flexibility

A key to successful American home design is the ability to cater to multiple clients’ desires. Previous attempts and novel, yet ultimately inflexible prefabricated building solutions have highlighted the public’s desire for customization.

The goal of this project is to produce a tangible building, but to do so within a new strategy for building design. The strategy should be flexible enough to be implemented around the southwest while using local production processes and materials.

The use of CAD-CAM will also allow rapid customization with minimum loss of time and cost. Unique possibilities for form-making while using standard materials is an exciting possibility with CAD-CAM and should definitely be leveraged in the future of prefabricated design.

In the end, the success of prefabrication depends on its ability to be flexible, yet only through prefabrication can flexibility be responsibly achieved.

Prefabrication has been used in many locales, from urban to suburban, city to rural. Its application within dense or easily accessed locations has been well refined, but its more remote incarnations can be clumsy and wholly unresponsive to context. It is this more delicate application of prefabrication that will be the focus of this project.

project description

REMOTE HOME:

A prefabricated home with componentry optimized for simple fabrication and human-scale labor.

This project explores the benefits of linking digital design and prefabrication to maximize construction efficiency and minimize on-site delays. Its physically remote location also necessitates a highly light and mobile solution that is simple in construction.

This project is being developed because the single family home typology will not be abandoned in the near future. Therefore, an efficient design strategy is needed that addresses both energy and resource consumption along with material waste; all are issue issues that plague the housing industry. The resulting strategy will be adaptable to satisfy a multiplicity of client needs inherent in custom housing and be regionally deployable within the semi-arid Southwest.

CRITICAL FOCUS:

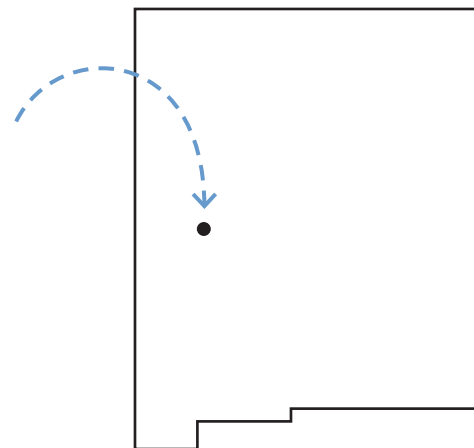
portability

pre/post fabrication

performance

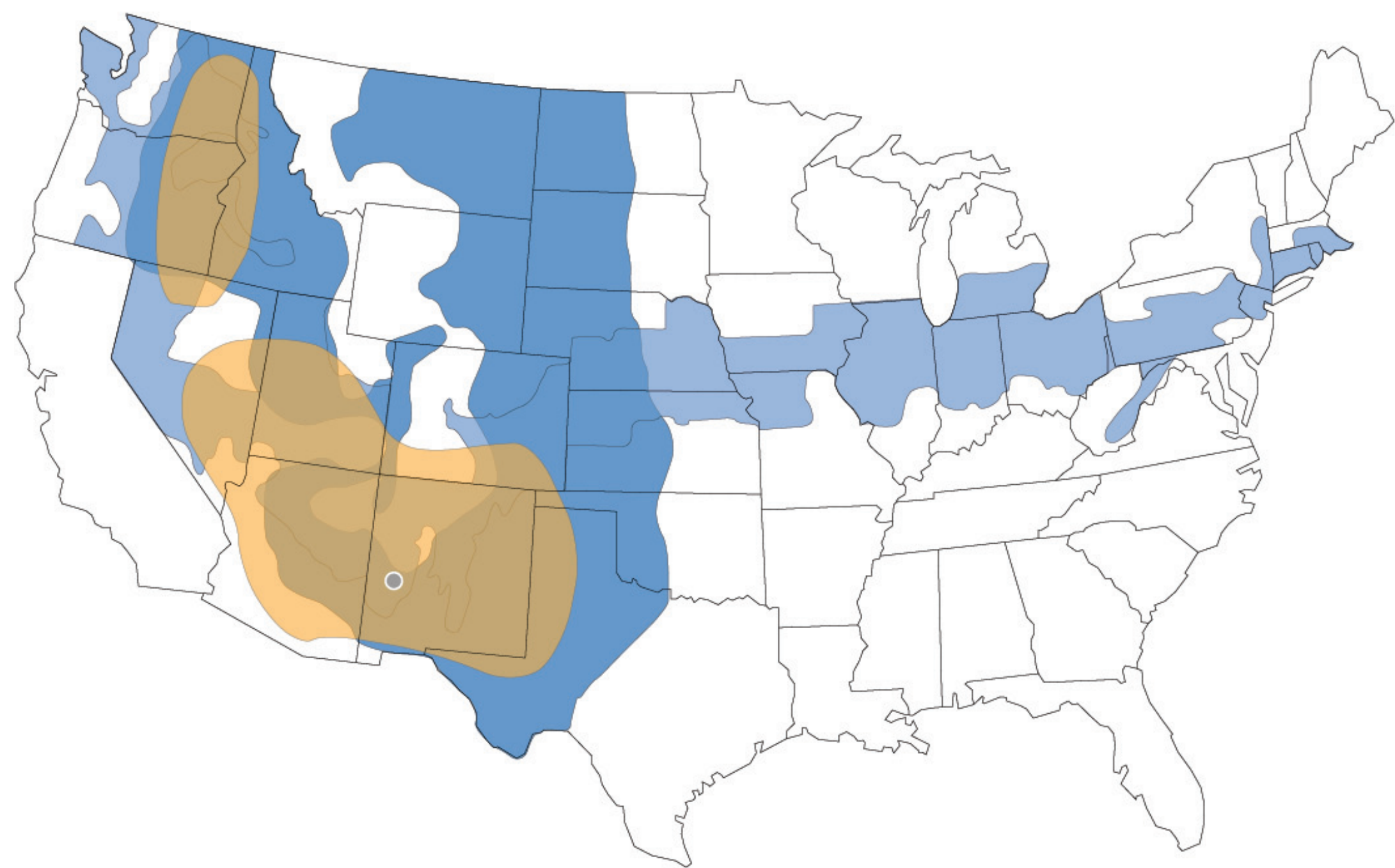
place





place

national climatic context



The site is located in western New Mexico along the boundary of many topographical and climatic zones. This demands both a flexible response to many changing weather conditions, but also allows the built solution to be applicable across a large area of the Southwest and inland Northwest.

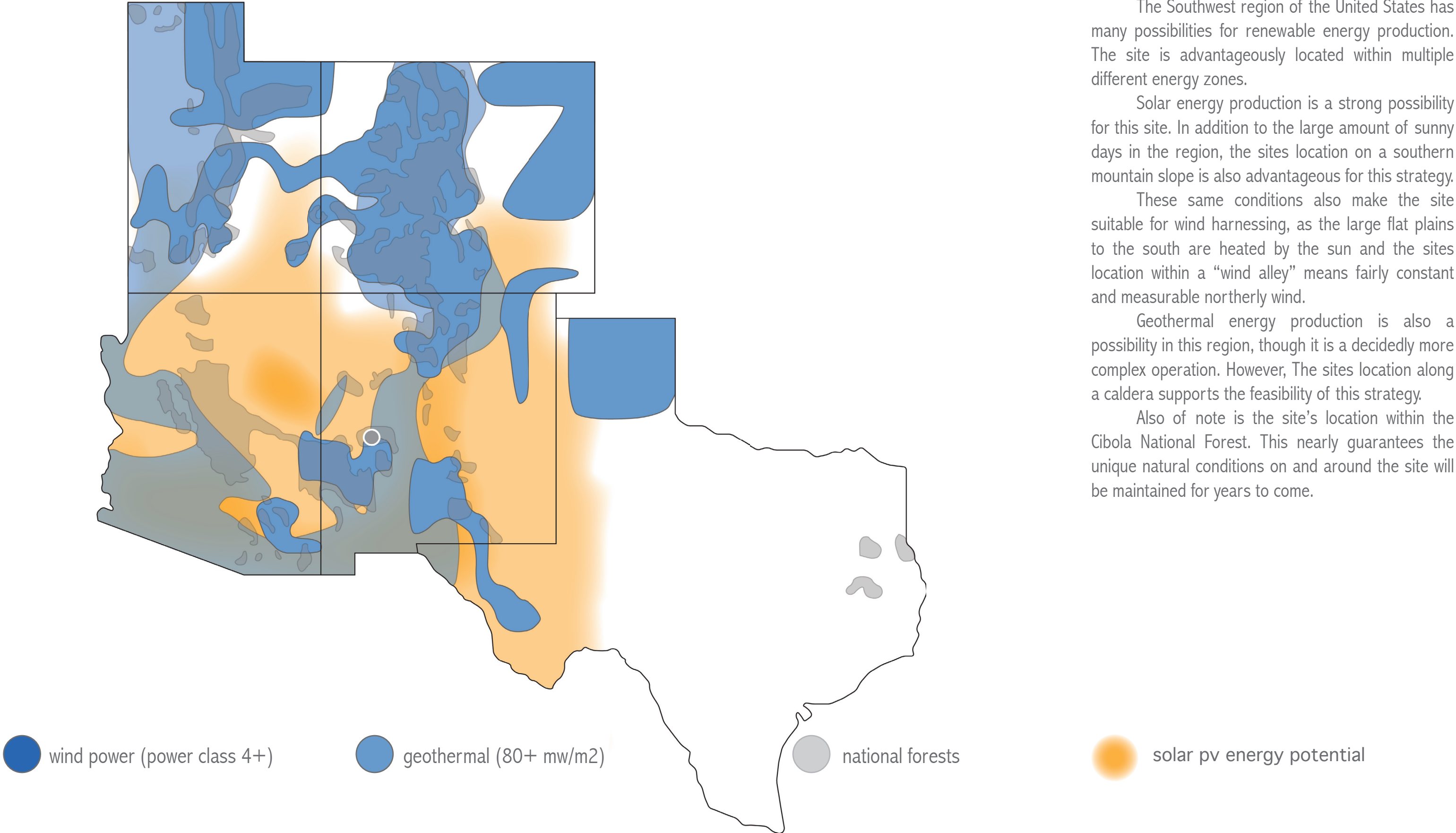
The project specifically falls within the semi-arid steppe climate that covers much of the lower mountainous and plateau areas of the Rocky Mountains. Semi-arid climates can be considered the transition between desert and humid climates, receiving low (but not extremely low) precipitation and wide temperature swings. Occasional but not persistent snow is possible as well. Vegetation is typically scrub brush, grasses and hearty drought-tolerant trees.

The site also falls within a zone characteristic of less than 2,000 cooling degree days and between 5,500 - 7,000 heating degree days. This reflects the large temperature swings possible for most of the year, with warm to hot days and cold to very cold nights.

Although this specific project will respond to its immediate context with material choice and energy strategies, the organization and construction strategies should be applicable regionally.



regional renewable energy potential



The Southwest region of the United States has many possibilities for renewable energy production. The site is advantageously located within multiple different energy zones.

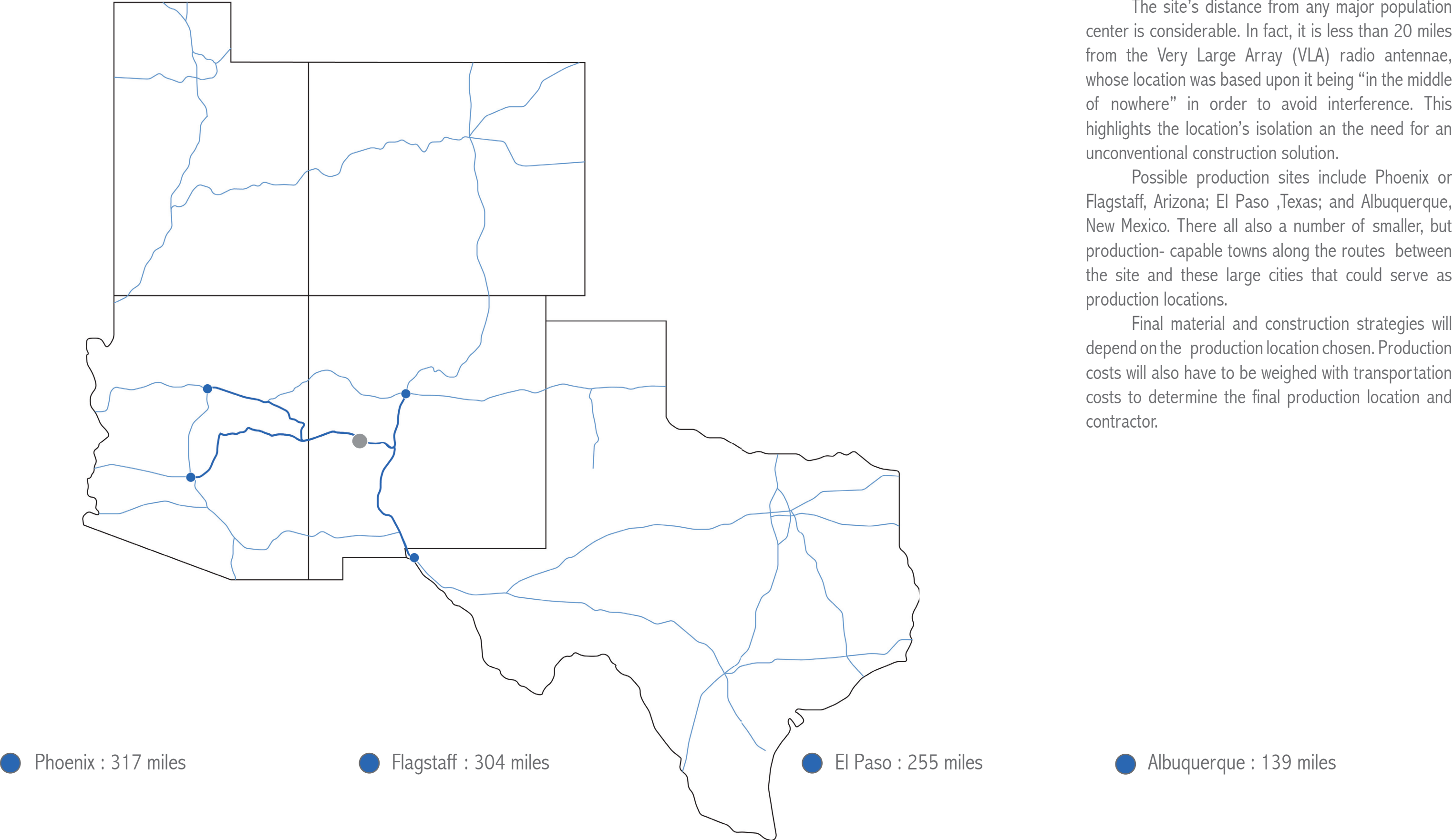
Solar energy production is a strong possibility for this site. In addition to the large amount of sunny days in the region, the sites location on a southern mountain slope is also advantageous for this strategy.

These same conditions also make the site suitable for wind harnessing, as the large flat plains to the south are heated by the sun and the sites location within a “wind alley” means fairly constant and measurable northerly wind.

Geothermal energy production is also a possibility in this region, though it is a decidedly more complex operation. However, The sites location along a caldera supports the feasibility of this strategy.

Also of note is the site’s location within the Cibola National Forest. This nearly guarantees the unique natural conditions on and around the site will be maintained for years to come.

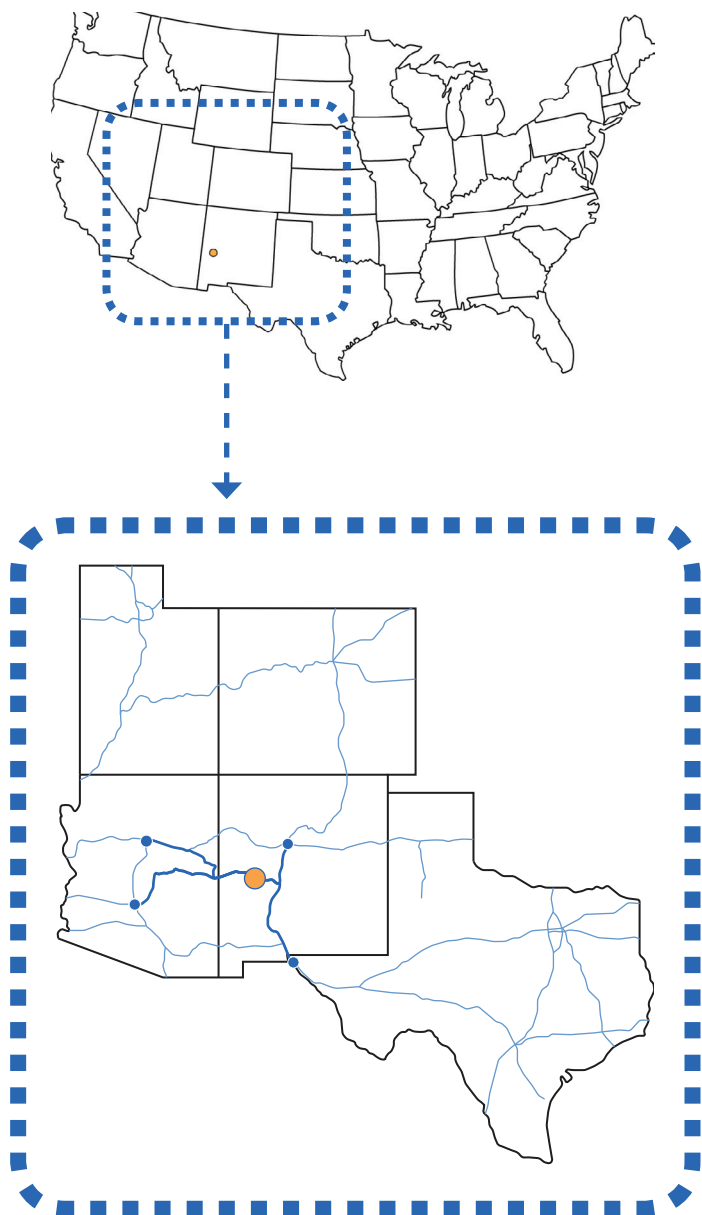
regional travel distances



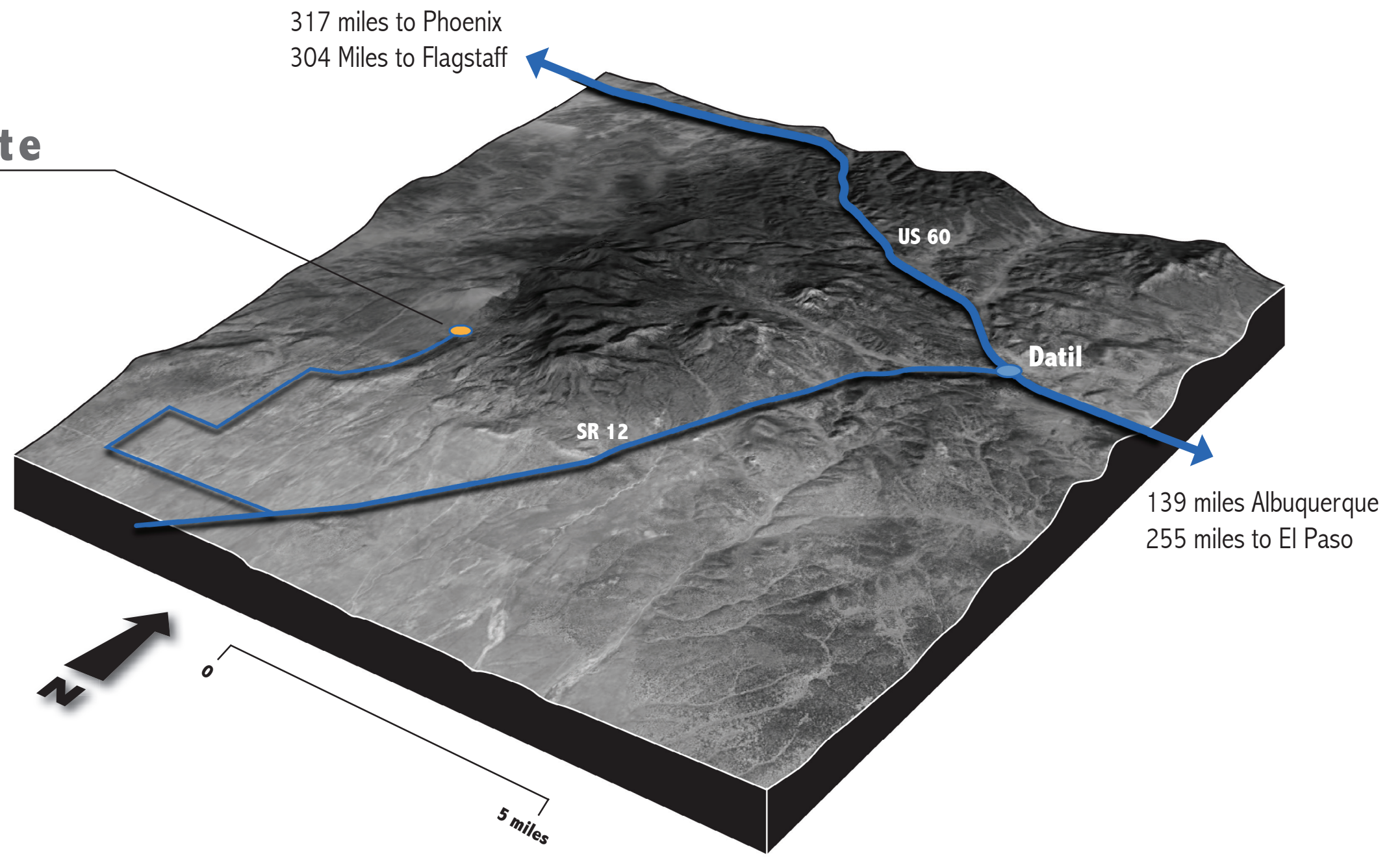
The site's distance from any major population center is considerable. In fact, it is less than 20 miles from the Very Large Array (VLA) radio antennae, whose location was based upon it being "in the middle of nowhere" in order to avoid interference. This highlights the location's isolation and the need for an unconventional construction solution.

Possible production sites include Phoenix or Flagstaff, Arizona; El Paso, Texas; and Albuquerque, New Mexico. There are also a number of smaller, but production-capable towns along the routes between the site and these large cities that could serve as production locations.

Final material and construction strategies will depend on the production location chosen. Production costs will also have to be weighed with transportation costs to determine the final production location and contractor.



site

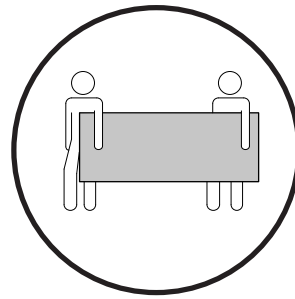


Datil ► **population: 490** **elevation: 7,385 ft.** **max average temp: 95°** **min. average temp: 20°** **average precipitation: 12"** **average snowfall: 31"**

assembly

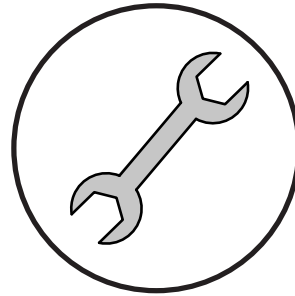
built by homeowner/local contractor

parts = people



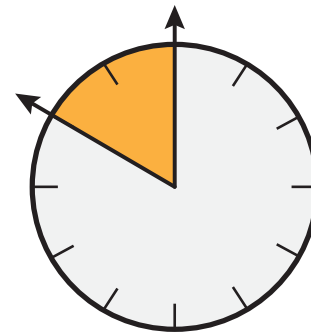
components are light enough to be carried by no more than 4 people

joints



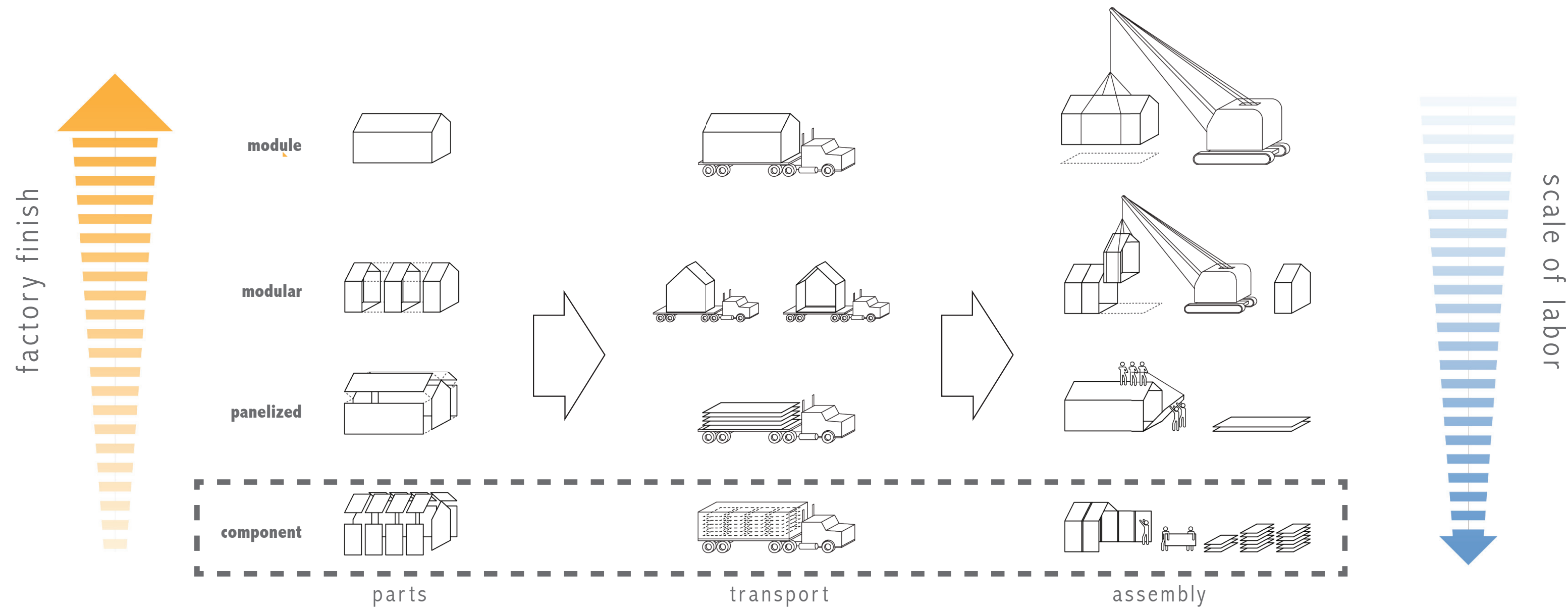
components are assembled with simple hand tools and a minimum of cuts

phasing



series of components can be assembled when finances allow

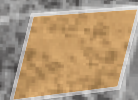
prefabrication typology selection



Due to the remote location of the project and the scale of the labor force that will assemble it the “component” typology is the most appropriate prefabrication strategy

local context

5 acre site



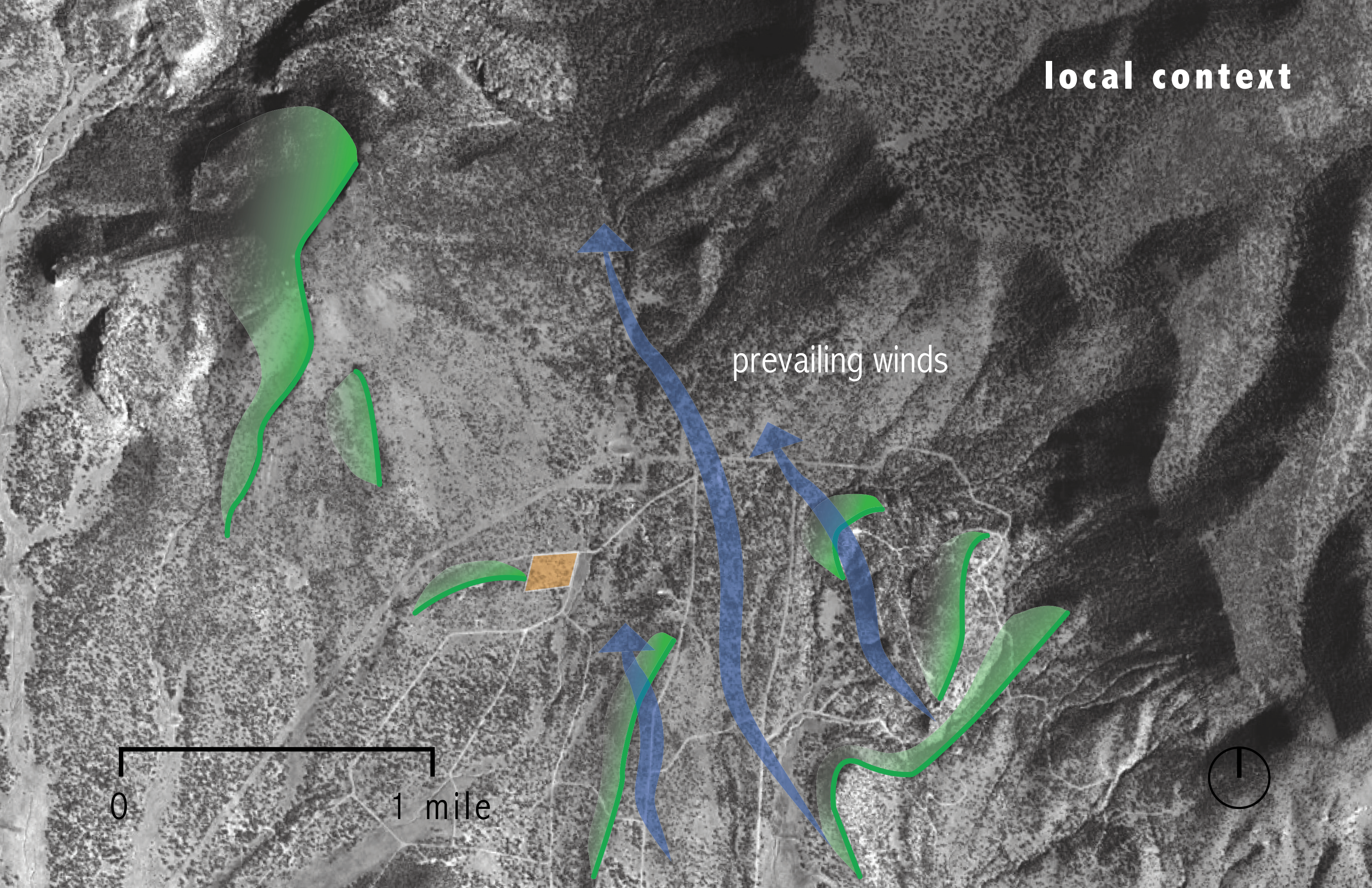
0 1 mile



local context

prevailing winds

0 1 mile



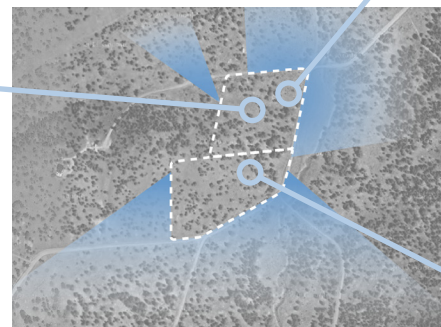
local context

views

0 1 mile



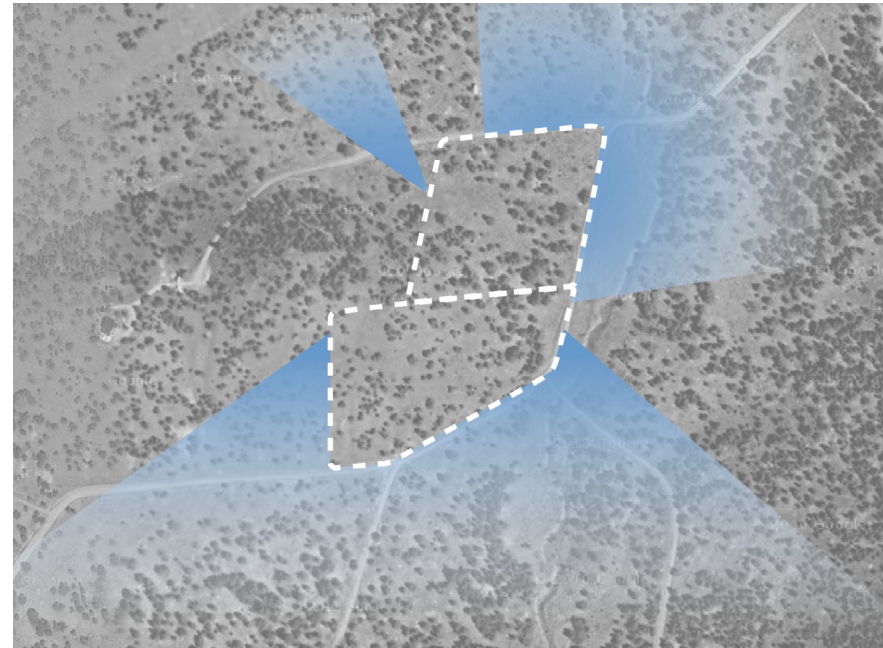
site context



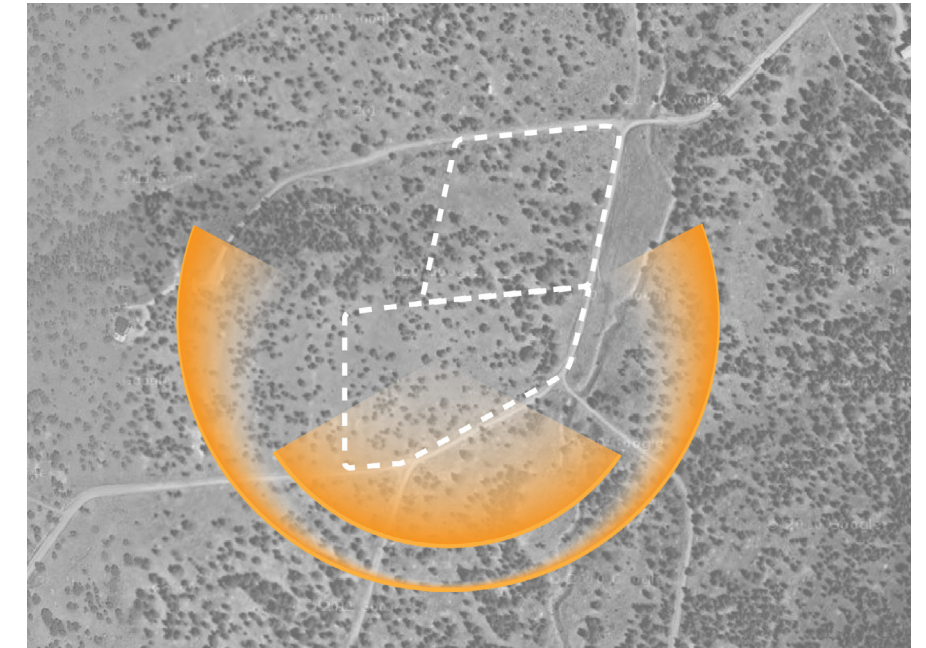
site context



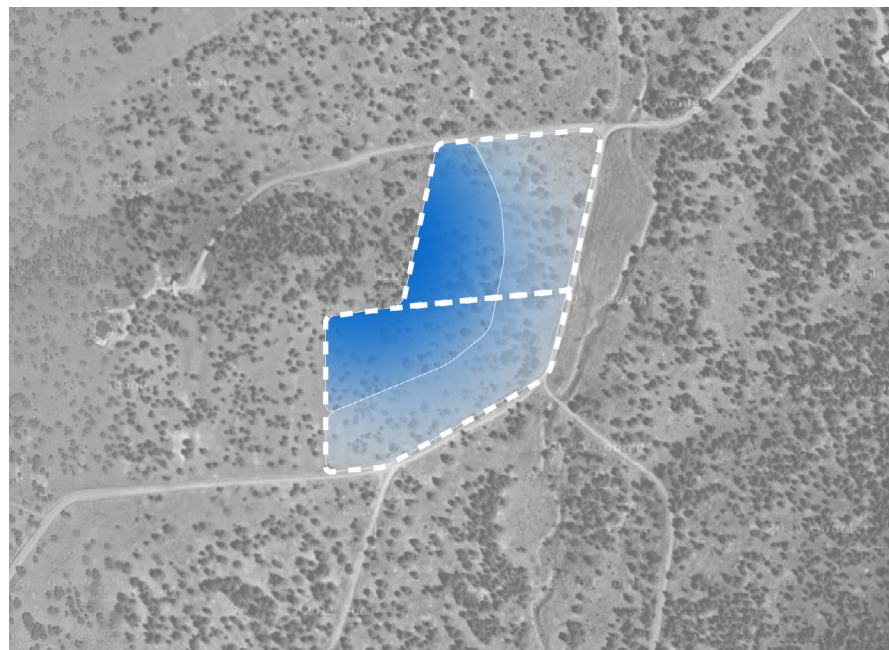
property lines and current camping location



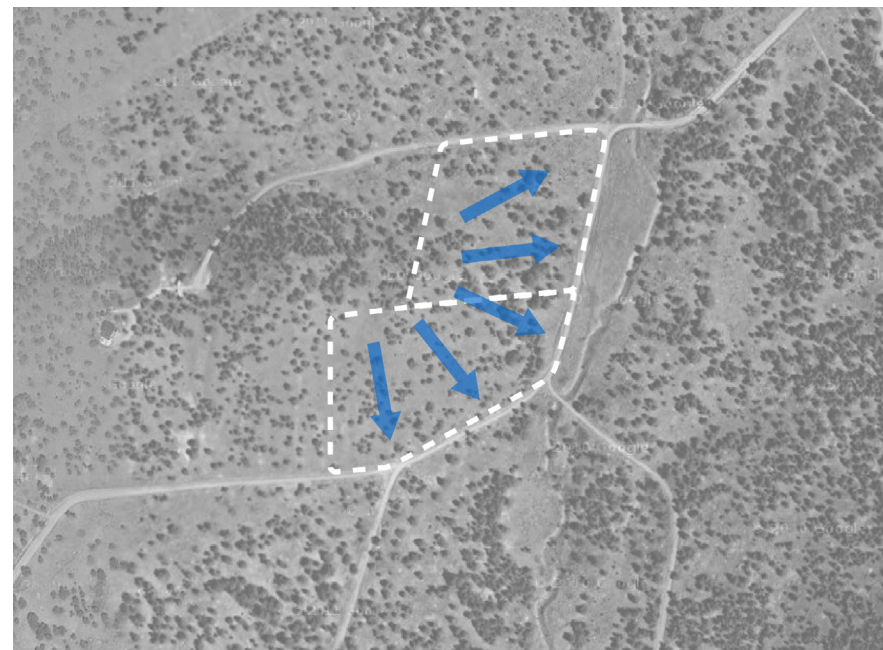
primary views from site



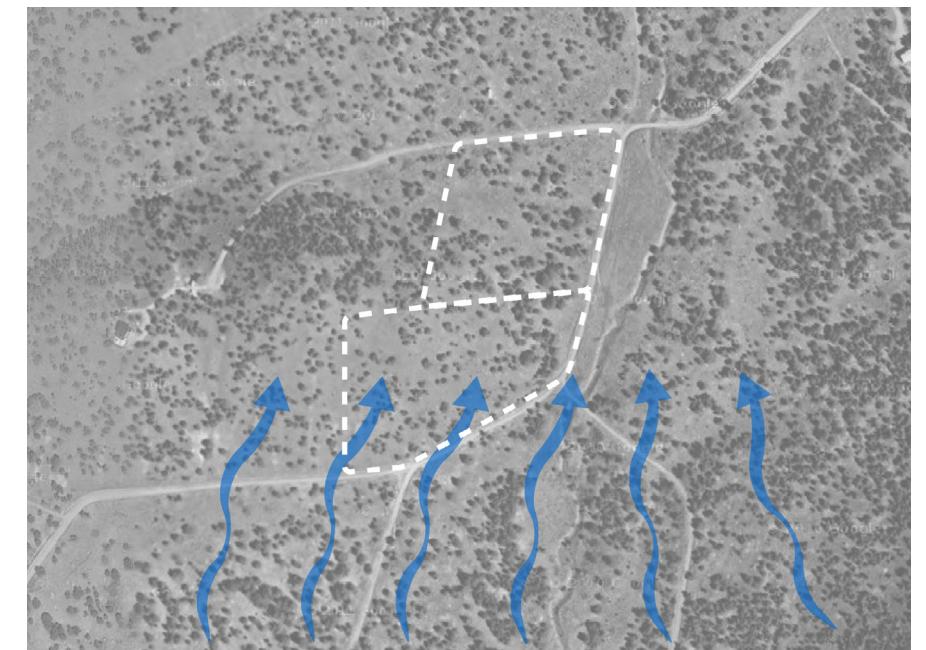
solar path at solstices



slope intensity

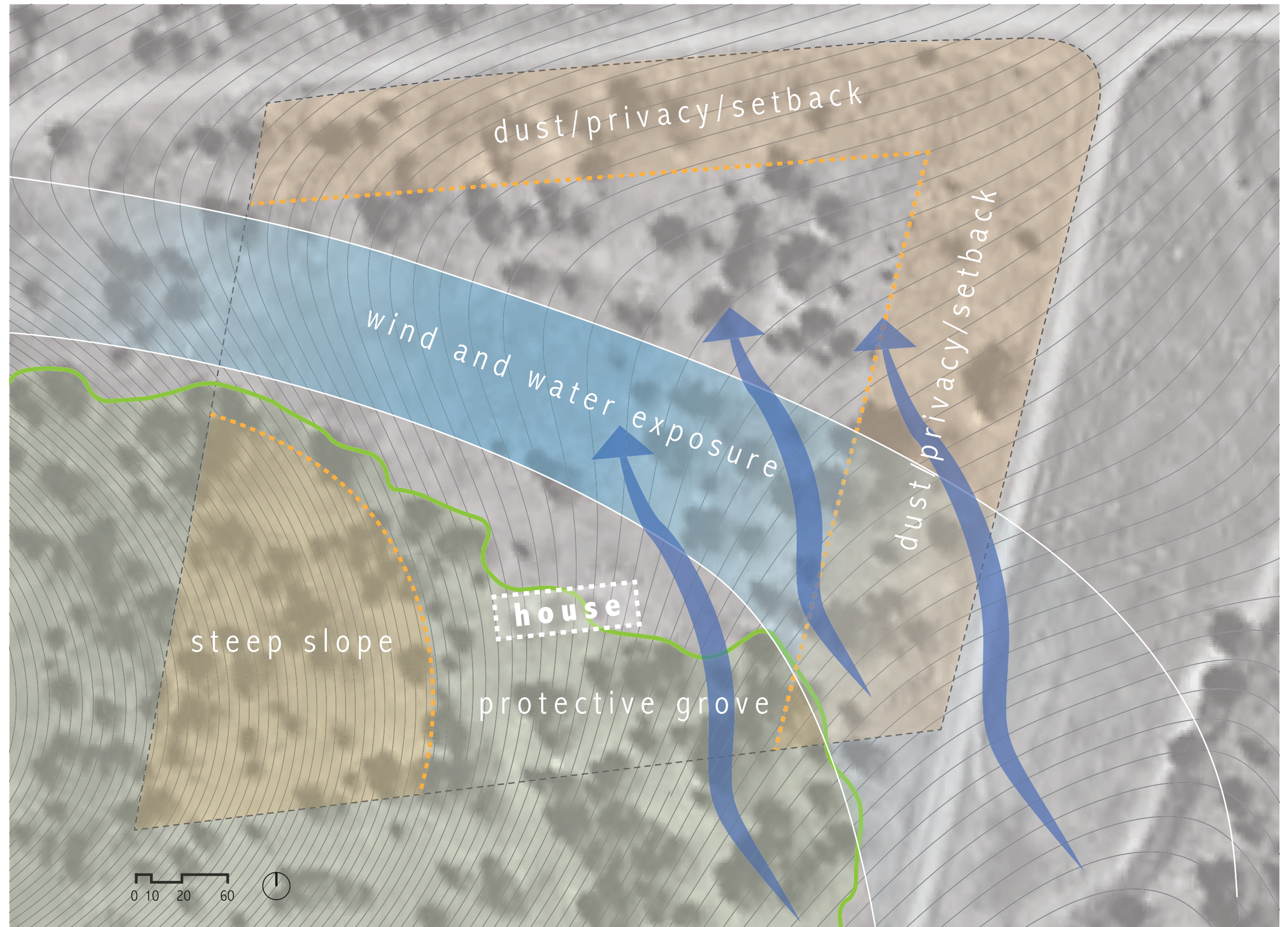


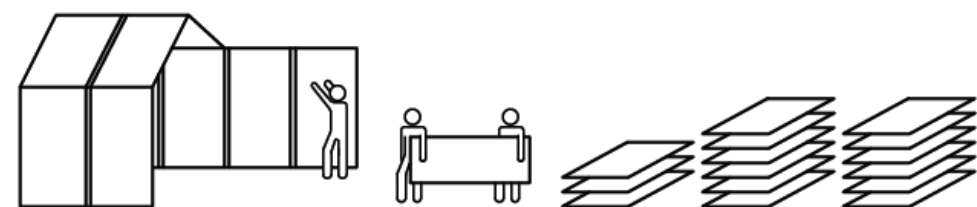
drainage



primary wind direction

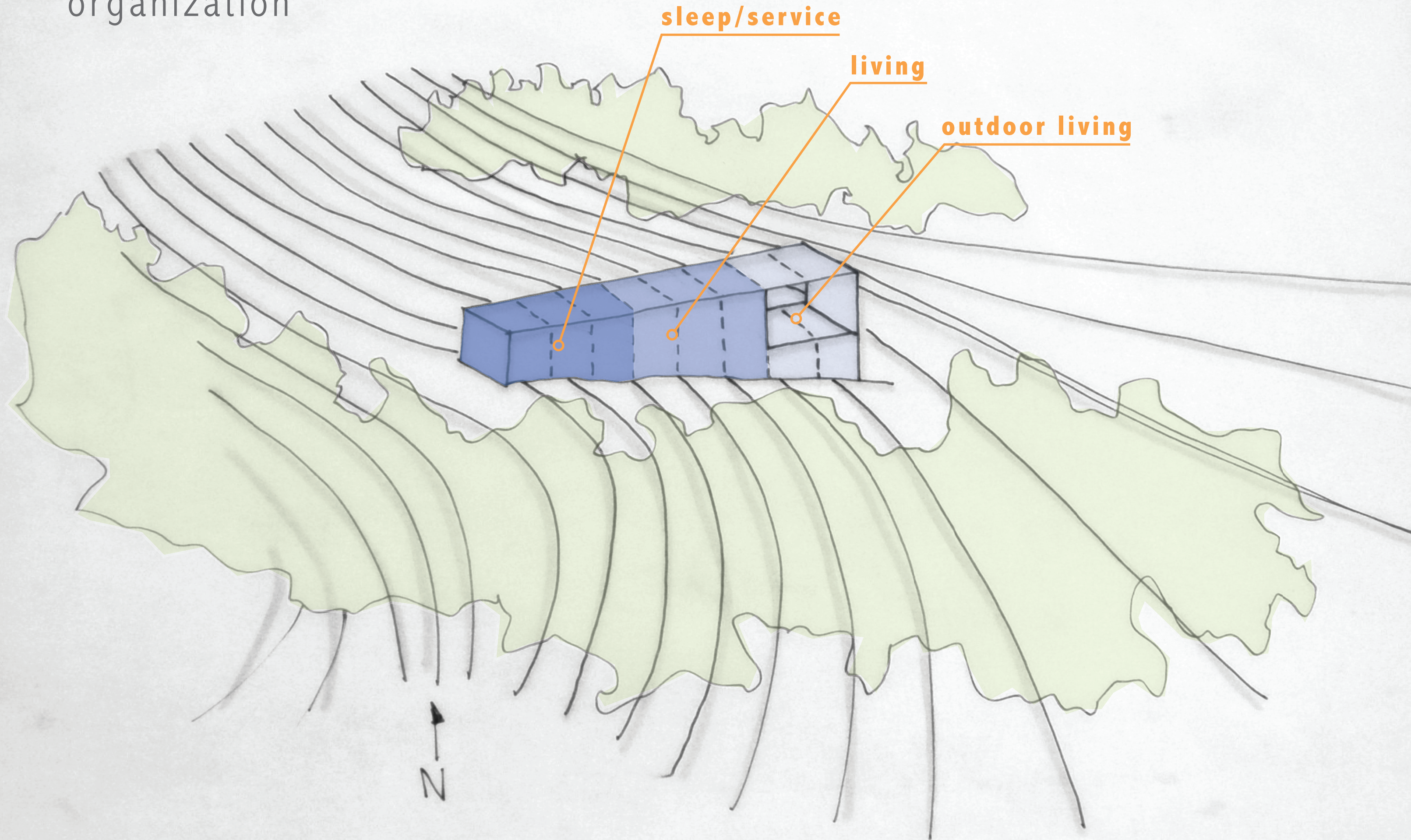
site context



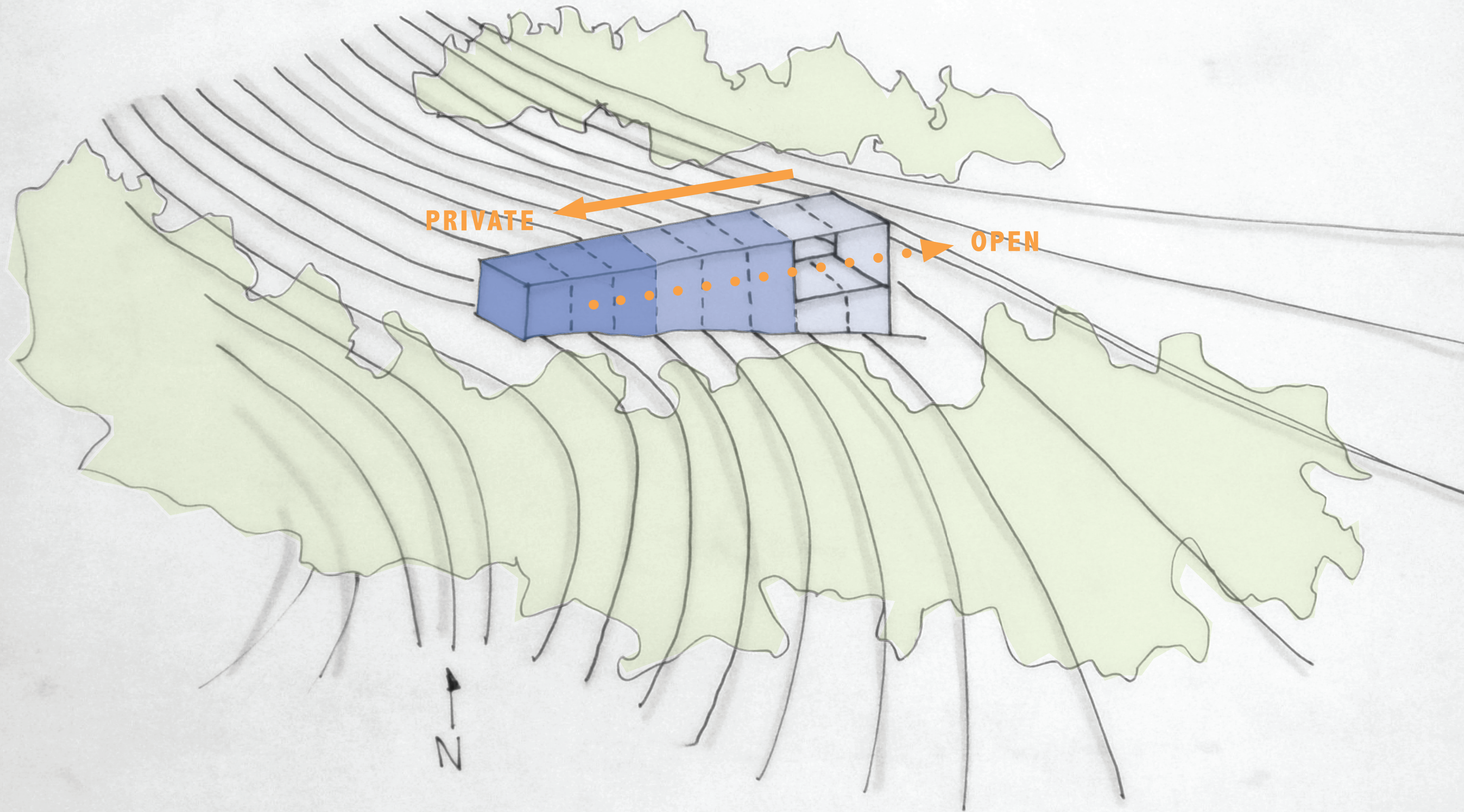


realization

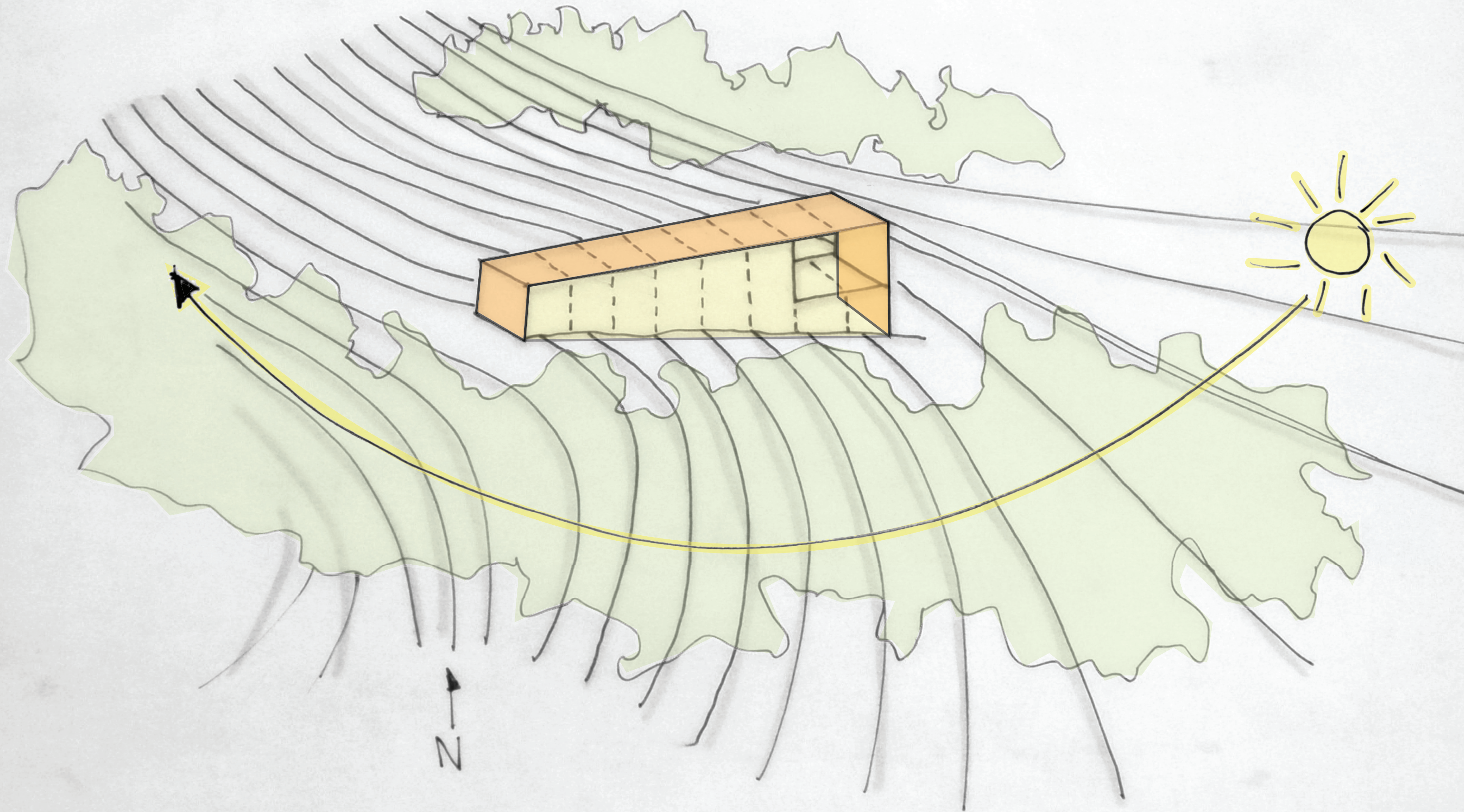
organization



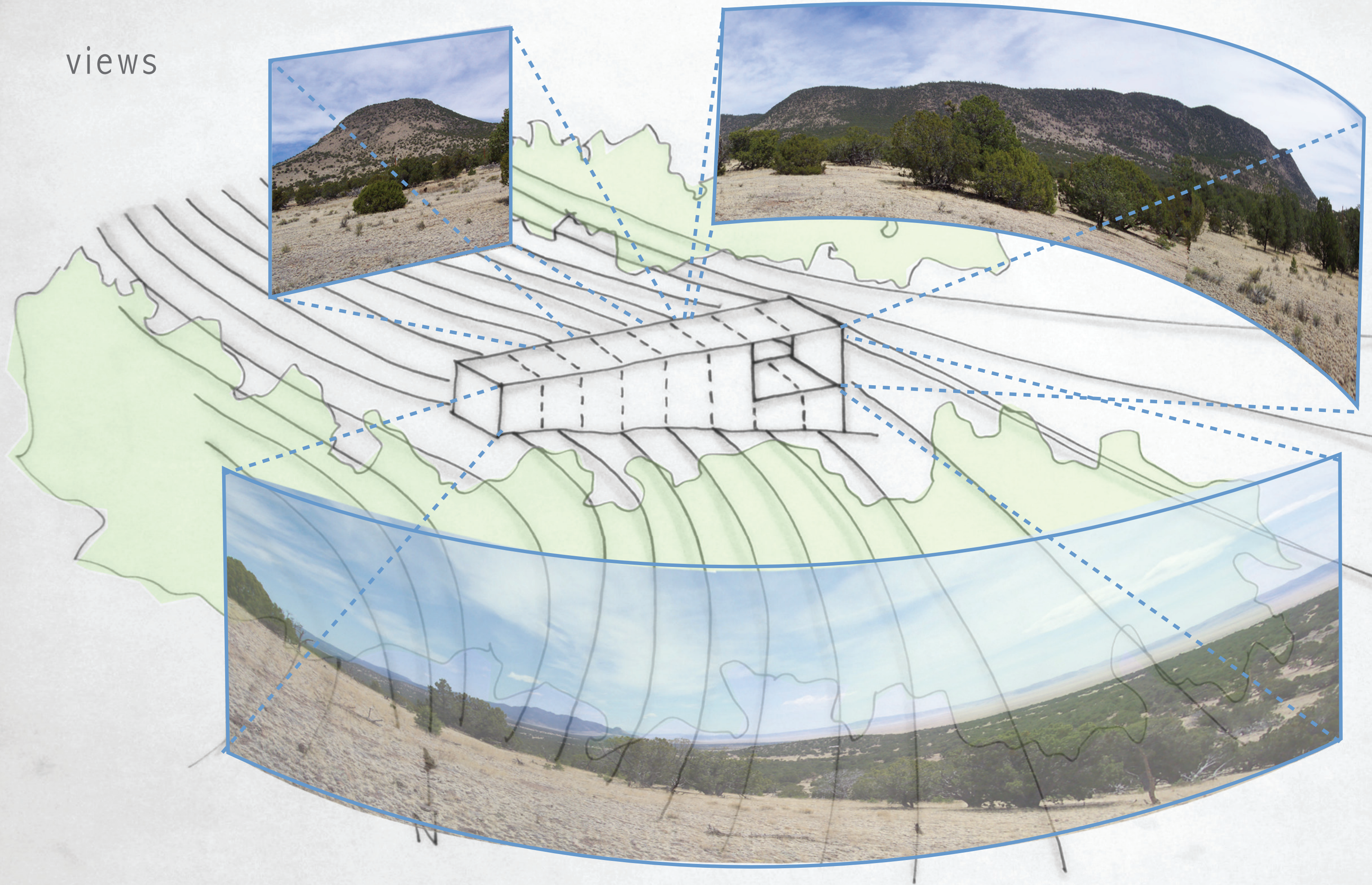
organization



solar orientation

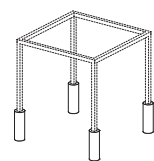


views



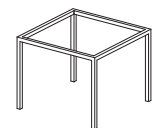
parts

performance



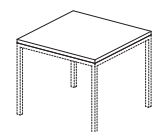
foundations

- 🔧 minimum amount of foundations reduces on-site work
- 🔧 system must be flexible enough to accommodate low precision site work with high precision prefab
- 🔧 minimum site disruption



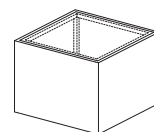
structural frame - 2ft. module

- 🔧 to be assembled with common tools: no “wet joints” in the field
- 🔧 components must be transportable by no more than four people
- 🔧 components must conform to typical available lengths and minimize unusable drops



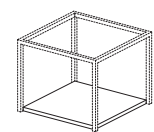
roof

- 🔧 elimination of complex joints: hips, valleys, peaks
- 🔧 minimize penetrations
- 🔧 if possible, oriented for optimal PV and solar heating efficiency
- ⚡ maximum insulative capability
- 💧 used to capture rain runoff



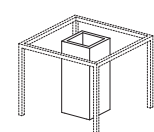
exterior walls - 2ft. module

- 🔧 transportable by four people at the most
- 🔧 assembled by simple tools, with dry joints, and no cuts should be necessary
- 🔧 as much as possible systems should be eliminated form the exterior envelope
- ⚡ maximum insulative capacity



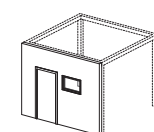
floor

- 🔧 transportable by four people at the most
- 🔧 assembled by simple tools, with dry joints, and no cuts should be necessary
- 💧 heating/cooling/plumbing/electrical systems directly integrated
- ⚡ maximum insulative capacity



interior walls

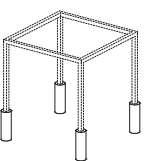
- 🔧 transportable by four people at the most
- 🔧 assembled by simple tools, with dry joints, and no cuts should be necessary
- 💧 heating/cooling systems directly integrated
- 🔧 finishes should be durable, easily replaced and recyclable



hardware

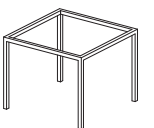
- 🔧 should adhere to the building module and be commonly available
- 🔧 should be layered to enhance usability: closed, open with screen, fully open
- ⚡ integrated with solar control devices (could double as security devices as well)
- ⚡ hardware spec'ed to preserve thermal envelope as much as possible.

selection



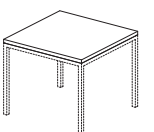
foundations

- PIER FOUNDATIONS - less groundwork, lightly touches the ground, compatible with sloped sites
- CONTINUOUS FOUNDATION - heavy ground work, suited for flat sites, helps retain heat below structure
- SCREW PILES - less groundwork, lightly touches the ground, compatible with sloped sites, recyclable/re-usable



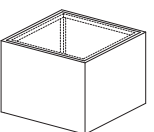
structural frame - 2ft. module

- STEEL - weather/termite/fire resistant, smaller profiles, possible to erect/disassemble with simple tools, 100% recyclable
- WOOD - cheap, readily available and renewable, more forgiving of errors, mostly recyclable
- ALUMINUM - lightweight, 100% recyclable, usually custom or exotic in application



roof

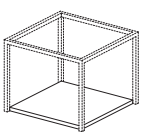
- METAL SIPS - weather/termite/fire resistant, made from partially recycled materials, recyclable, excellent insulation, easily assembled
- OSB SIPS - made from partially recycled materials, recyclable, excellent insulation, easily assembled
- CONVENTIONAL FRAMED - readily available materials, conventional technology, able to integrate systems
- LIGHT COVER - cheap, lightweight, easily recyclable



exterior walls - 2ft. module

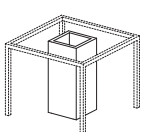
- METAL SIPS - weather/termite/fire resistant, made from partially recycled materials, recyclable, excellent insulation, easily assembled
- OSB SIPS - made from partially recycled materials, recyclable, excellent insulation, easily assembled
- CONVENTIONAL FRAMED WOOD - readily available materials, conventional technology, able to integrate systems
- CONVENTIONAL FRAMED METAL - readily available materials, conventional technology, able to integrate systems

- skin
 - metal - weather and fire resistant, lightweight, recyclable,
 - wood - readily available and renewable, cheap, generally recyclable
 - composite - made of recycled materials, weather and fire resistant



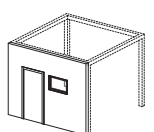
floor

- METAL FRAMED - fire and termite resistant, lightweight, true dimensions, adaptable
- WOOD FRAMED - readily available and renewable, cheap, generally recyclable
- COMPOSITE FRAMED - possibility for material savings/adaptation
- SYSTEMS PRE-INTEGRATED - outlets, water, waste, heating/cooling



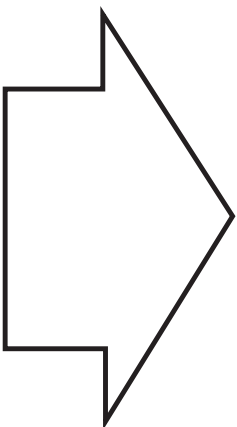
interior walls

- METAL FRAMED - fire and termite resistant, lightweight, true dimensions, adaptable
- WOOD FRAMED - readily available and renewable, cheap, generally recyclable
- COMPLETE CORES - higher level of finish, greater control, heavier modules
- SYSTEMS PRE-INTEGRATED - “heavy walls” will have all MEP pre installed with quick connect fittings

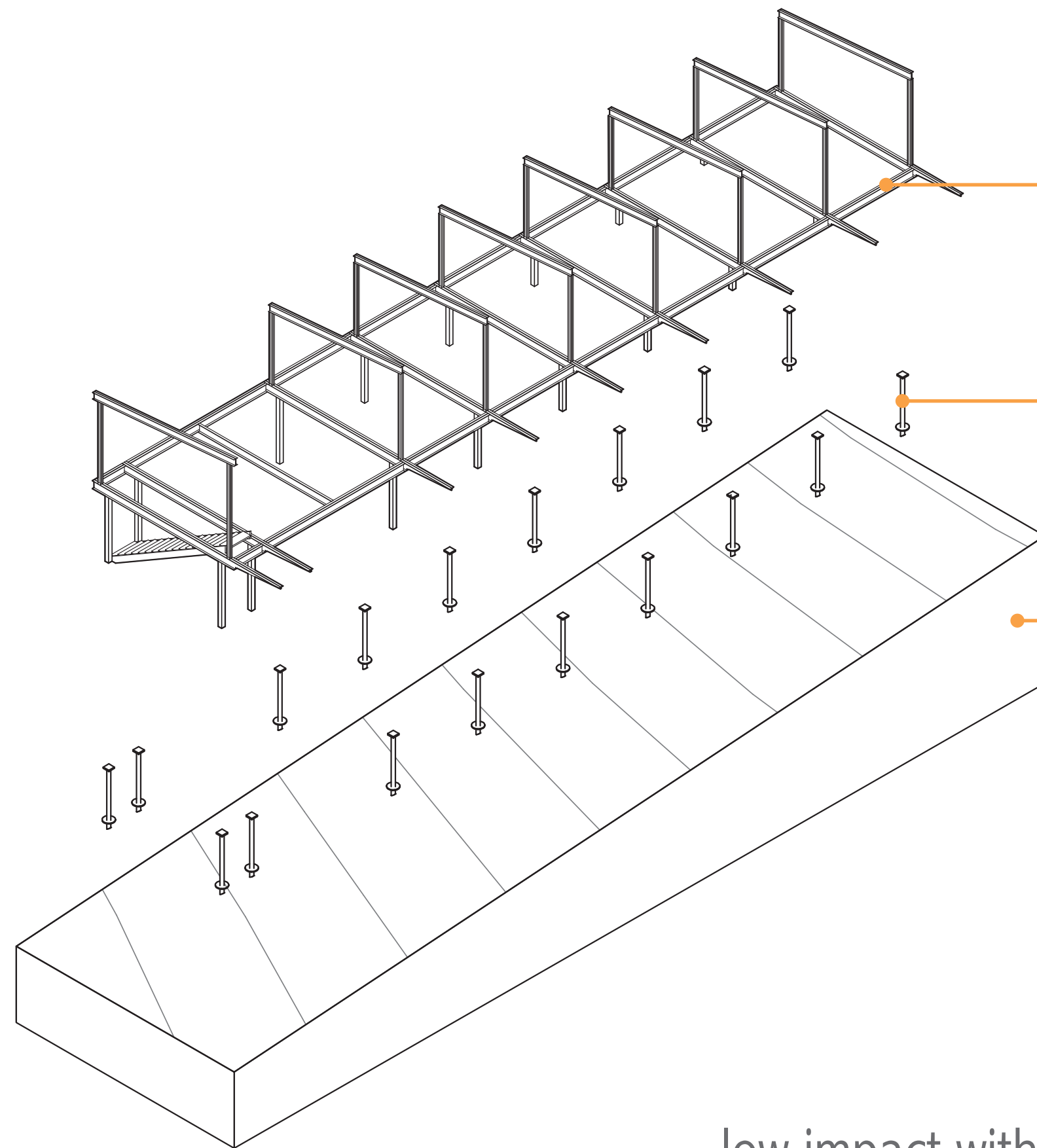
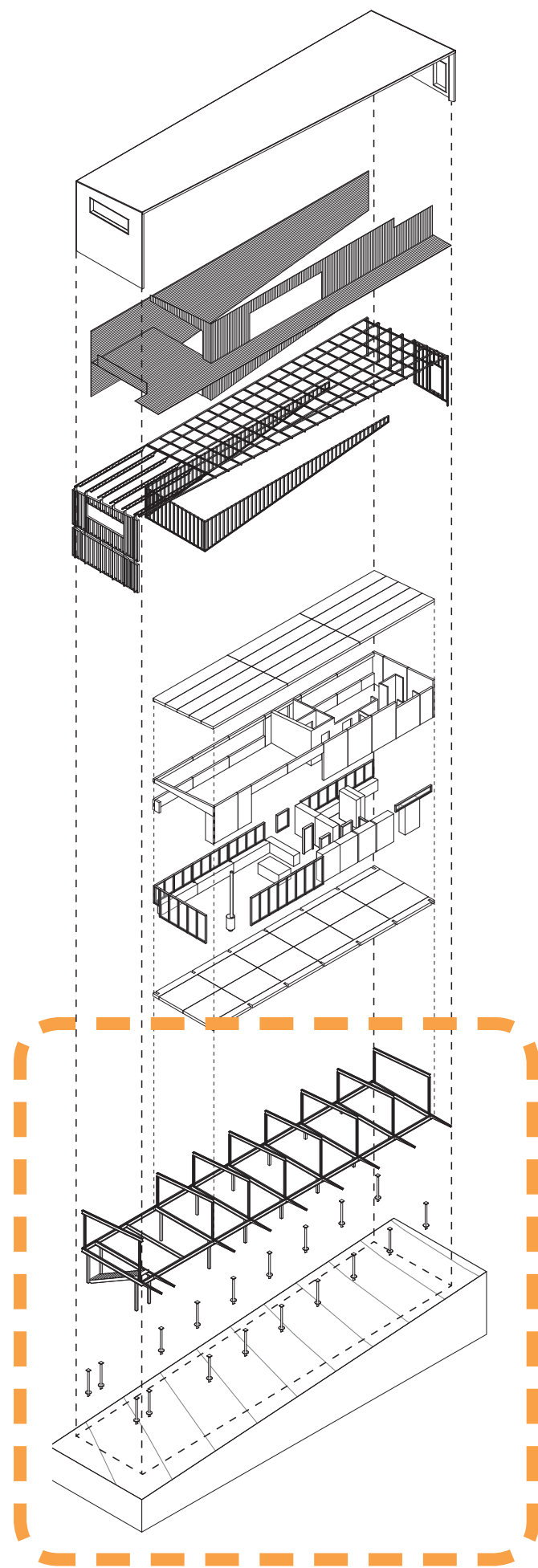


hardware

- CONSUMER HARDWARE - cheaper, readily available, tested, warrantied, durable
- CUSTOM HARDWARE - adaptable, “cleaner”
- INTEGRATED INTO WALL PANELS - all hardware will be pre-installed in exterior wall panels within established modules



All of the componentry for the Remote Home was selected after setting strict criteria and weighing the benefits of portability, availability, and performance. Typically the lightest and most durable (steel) components were selected, although in the case of the panelized envelope OSB SIPs were selected due to their availability and ubiquity within the residential construction industry. The goal of establishing these criteria was to allow the design to adapt in the future with a different site or a more restricted set of material choices. This underlies the essence of this project’s prefabrication: it is an organizational system rather than a specific set of components, and that system can be adapted to the site and the clients’ needs in different situations. It is meant to be fabricated by any fabricator using local materials according to availability and labor skills. Since there are no specific parts, just simple and ubiquitous components, no tooling or extra training is needed, and the design is flexible enough to accommodate any common building material.

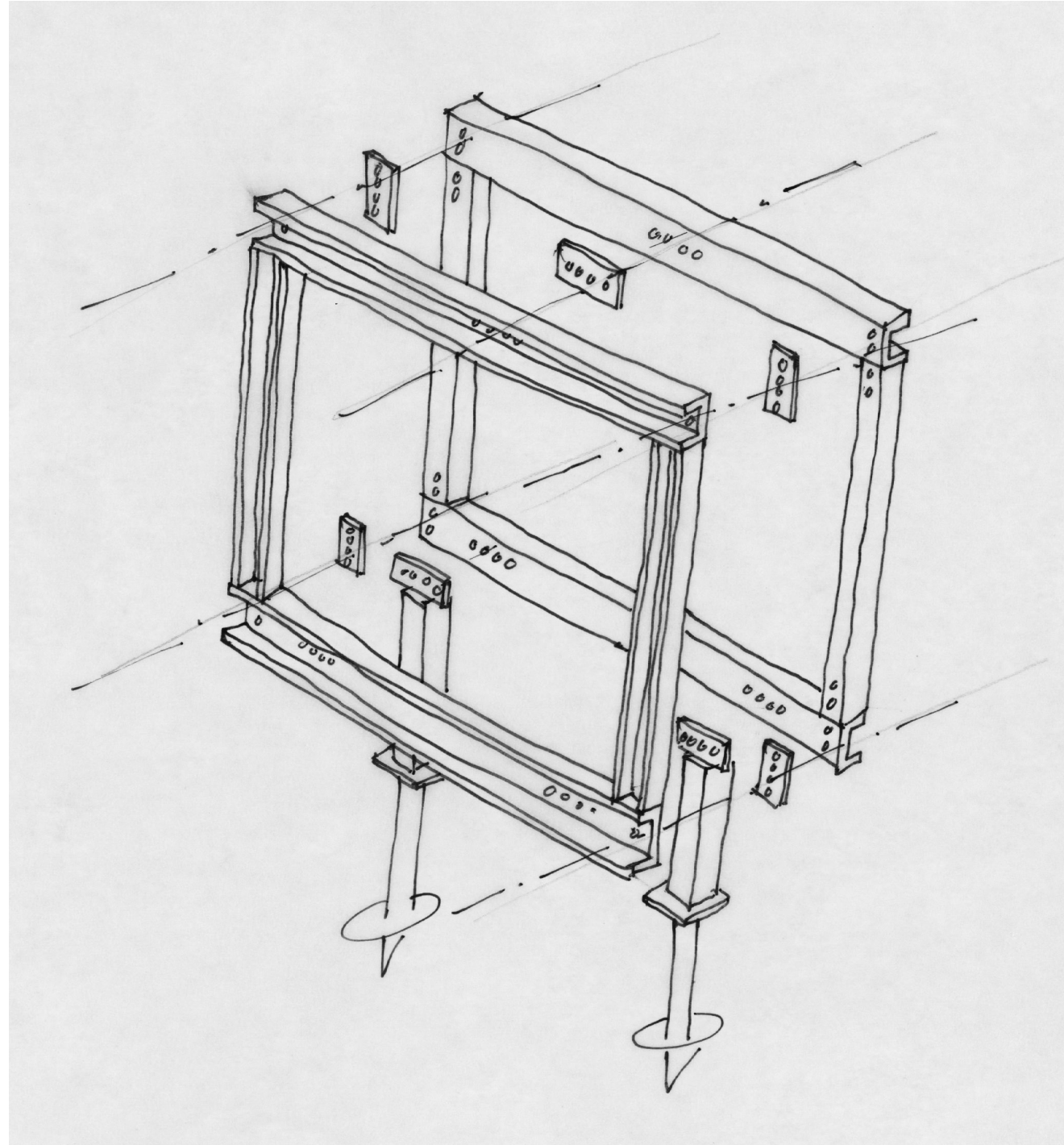
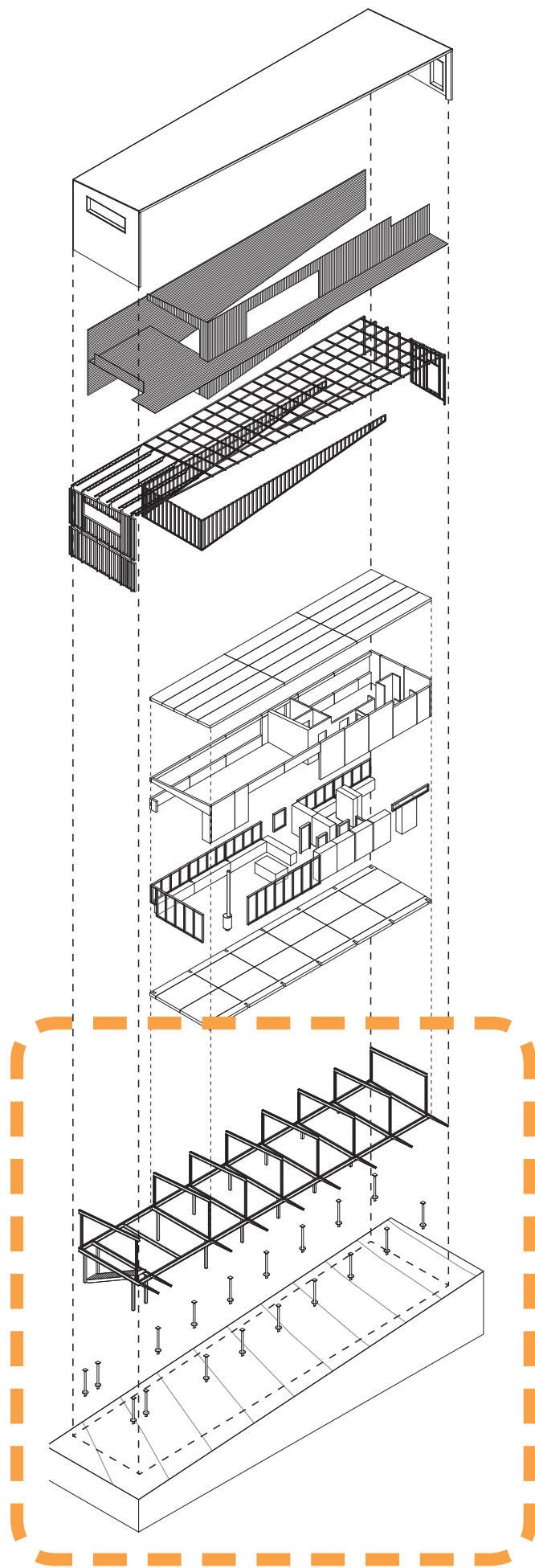


steel frame
bolted assembly of "C"
profiles to reduce weight

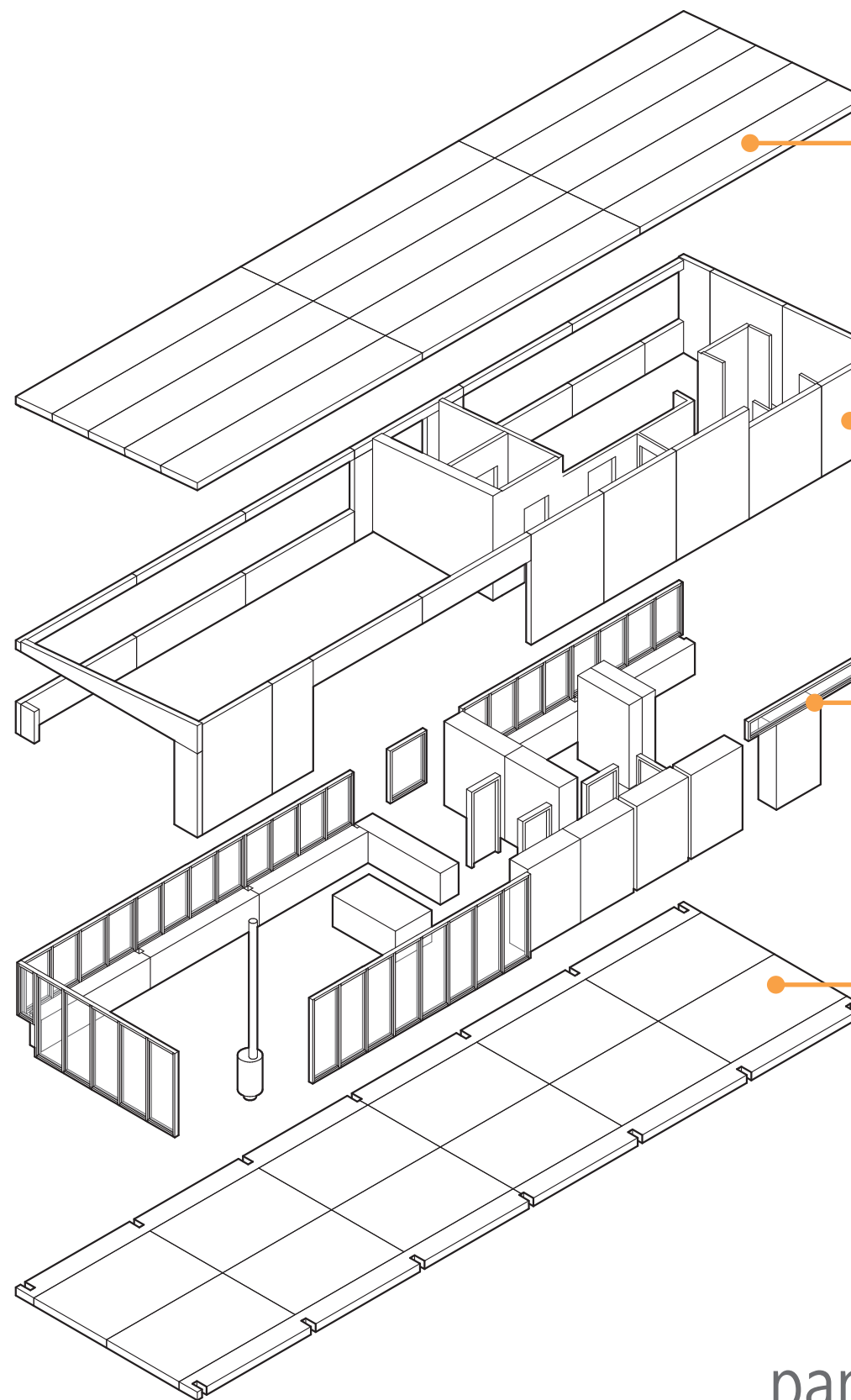
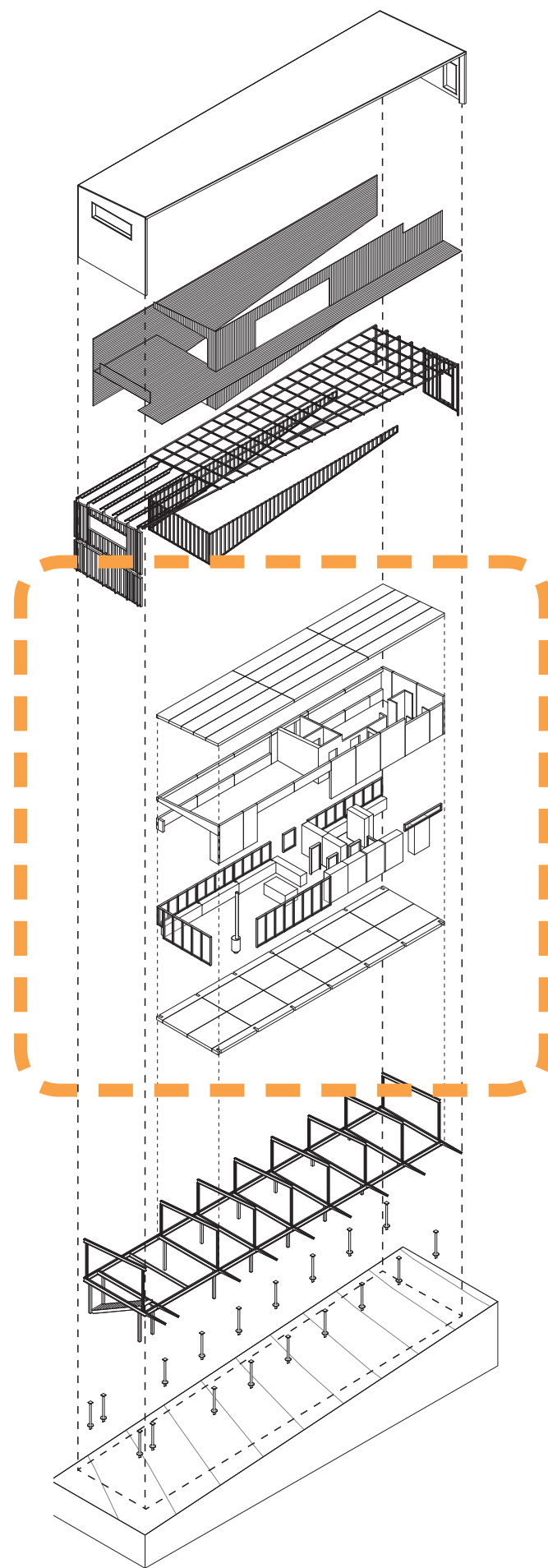
screw piles
no excavation necessary,
re-usable, recyclable

sloping site

low impact with simple installation



single structural bent



roof panels

4'x24' SIP construction

wall panels

exterior: SIP construction
interior: light gauge steel

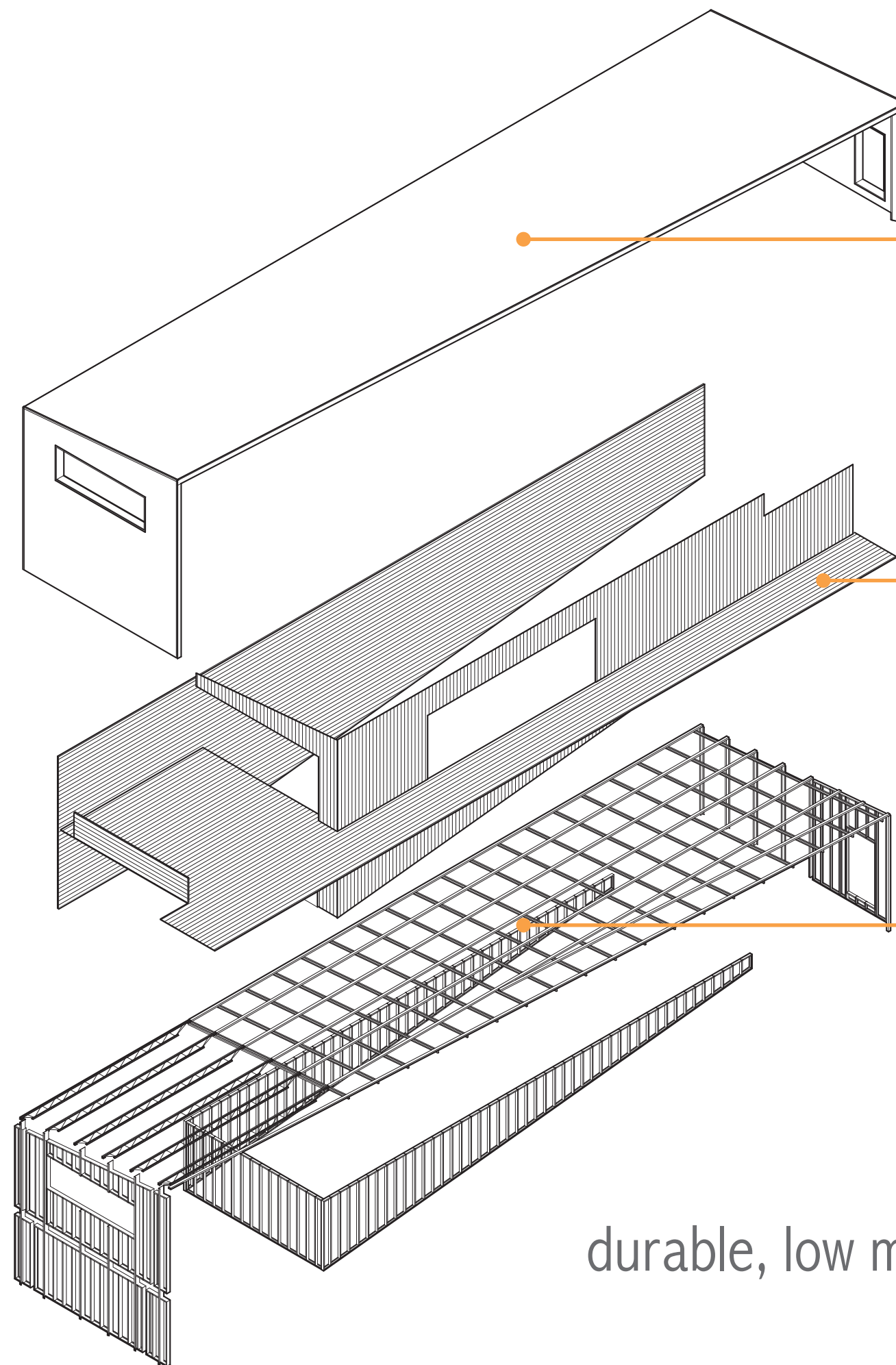
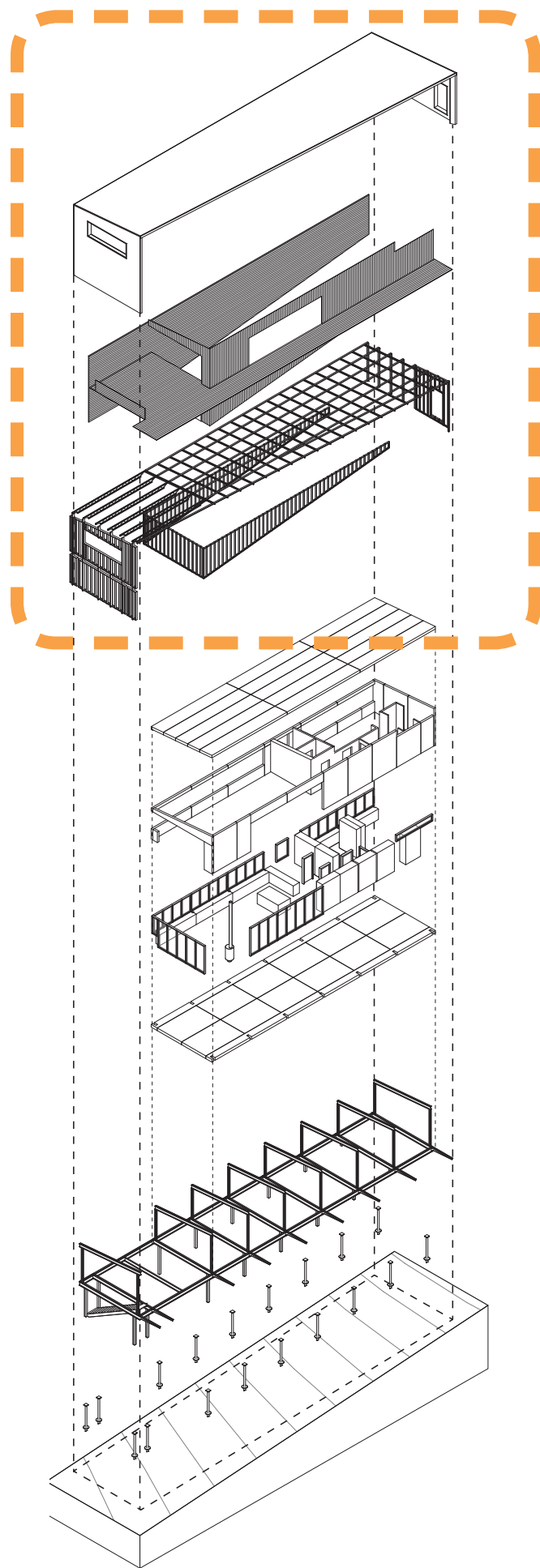
hardware

standard aluminum glazing
wired plywood furniture

floor panels

composite light gauge steel
framed sandwich panels,
contains plumbing/wiring

panelized thermal envelope



metal skin

corrugated, galvanized metal
for durability and protection

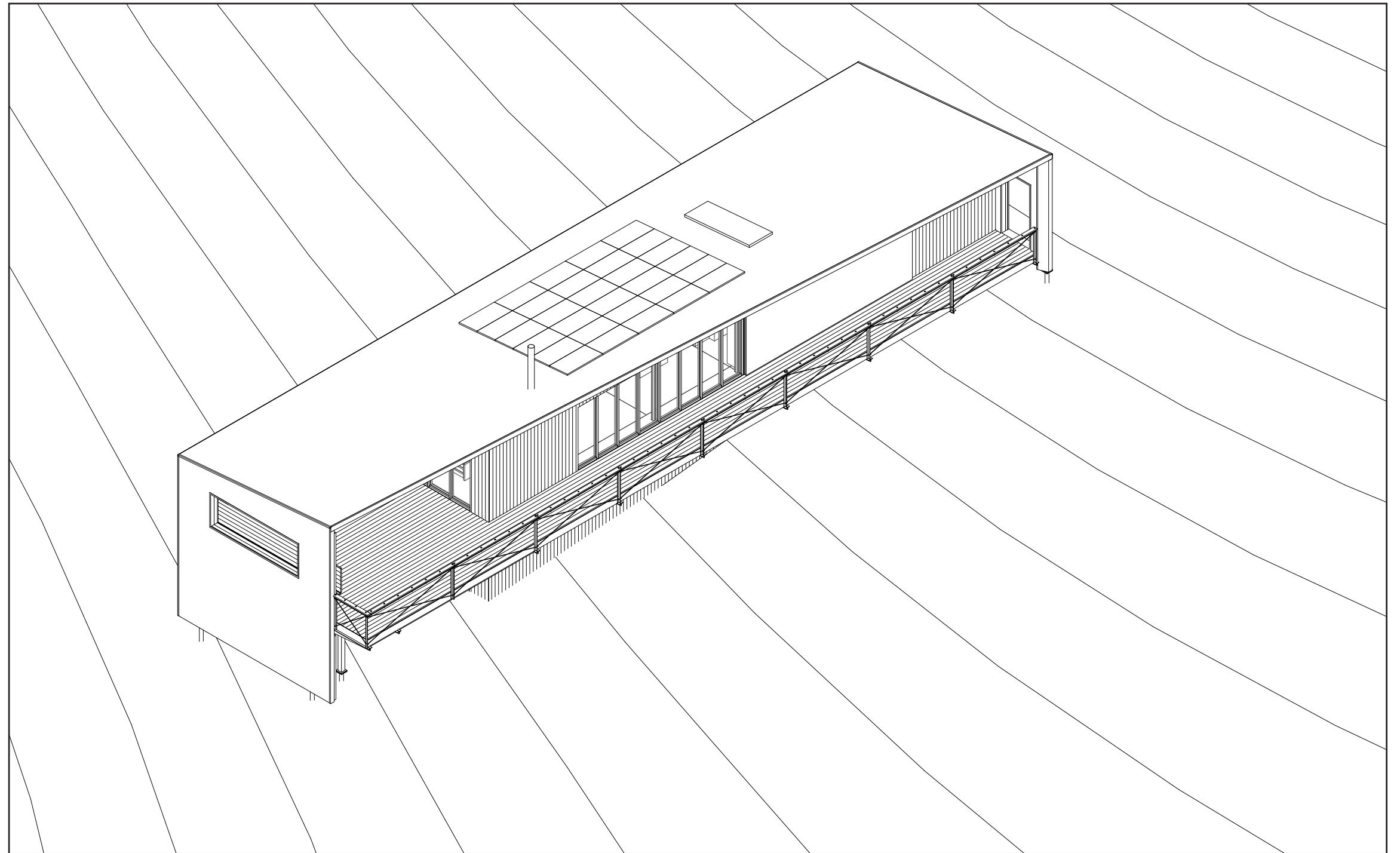
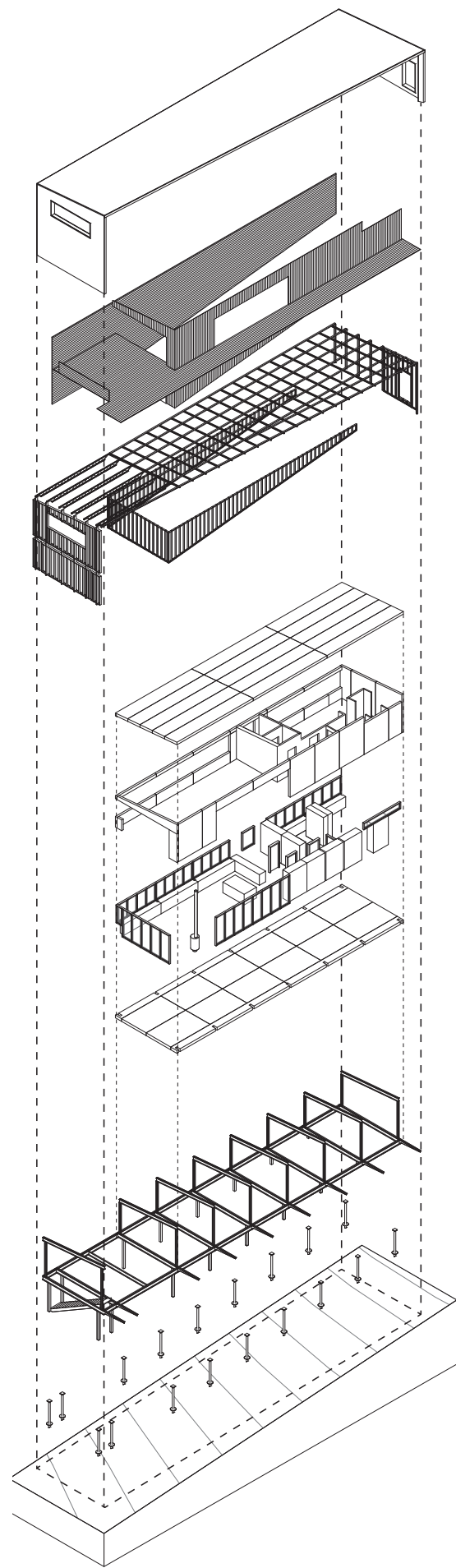
wood skin

recycled wood used for rain
screen around panelized
envelope

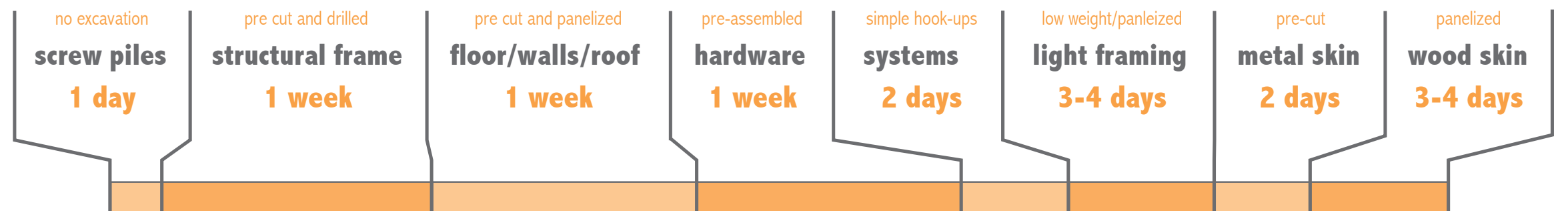
light framing

light steel framing used to
support exterior skin and
enclose lower area

durable, low maintenance materials



phasing:



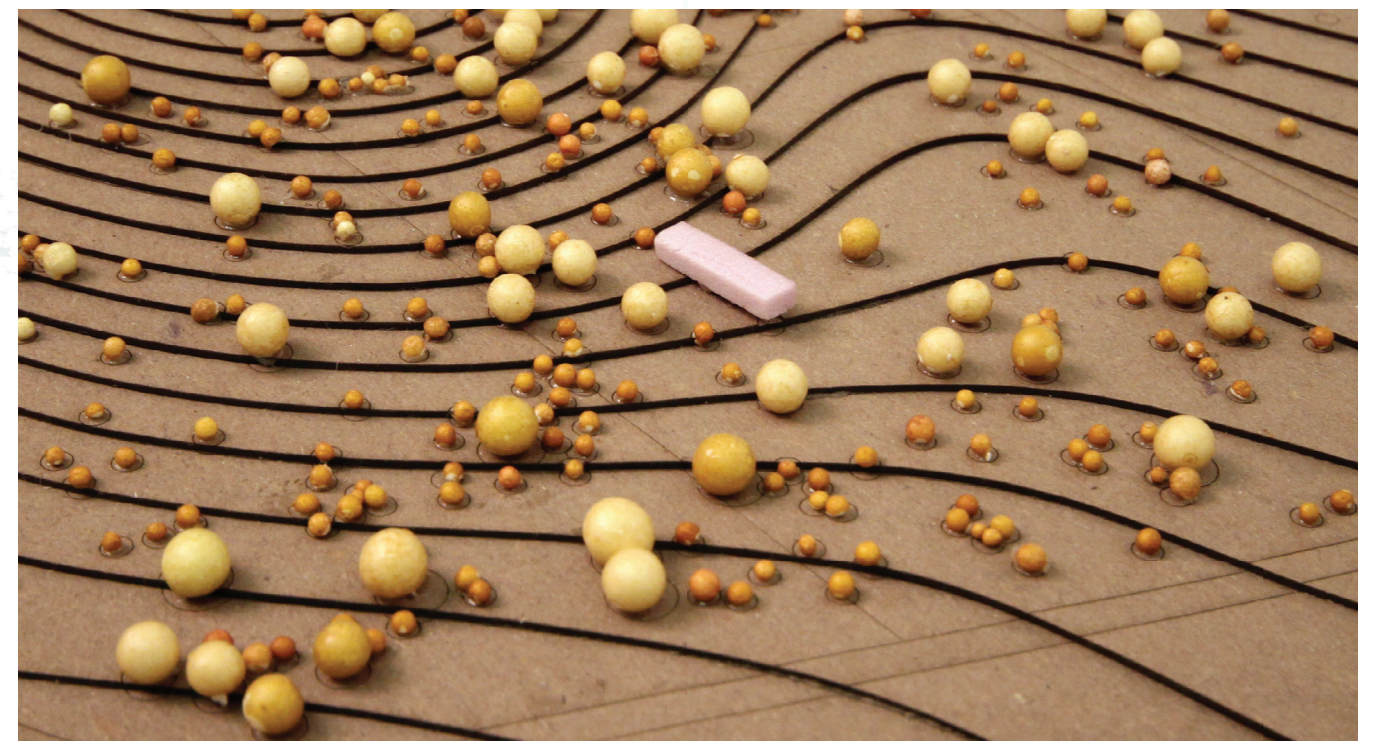
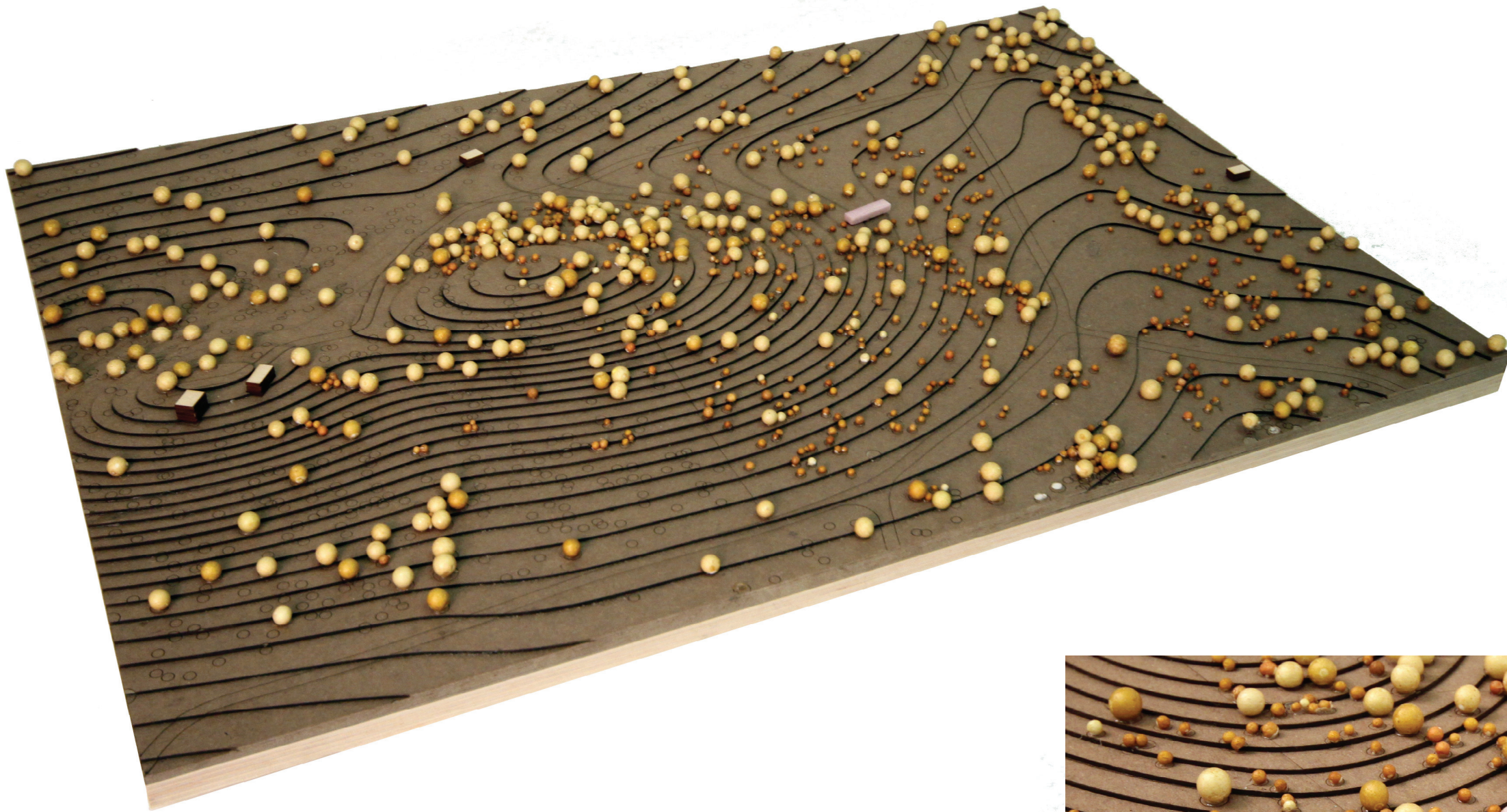
site plan



0 50ft 100ft 200ft



1:200 site model



1/16"=1' model

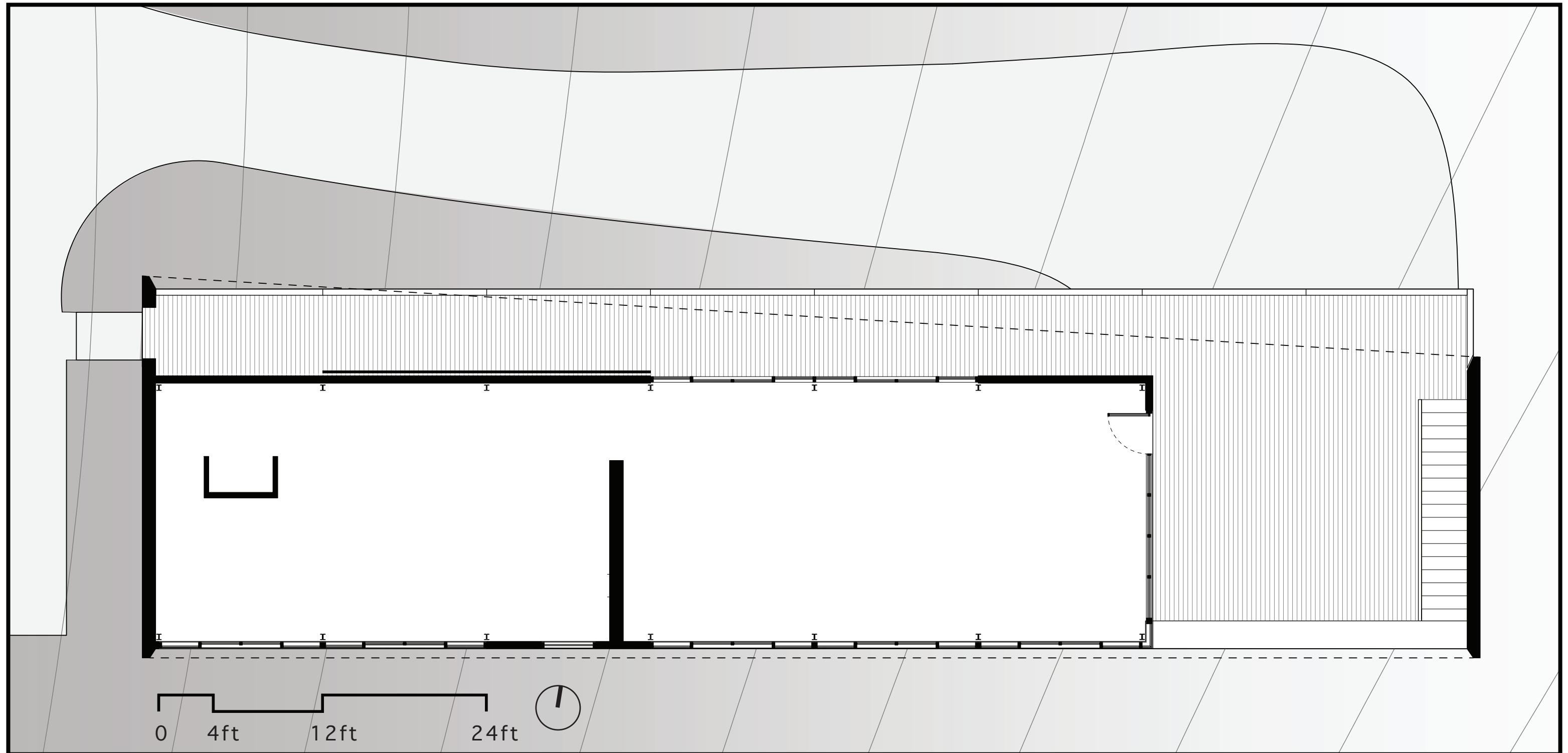


southern shaded facade



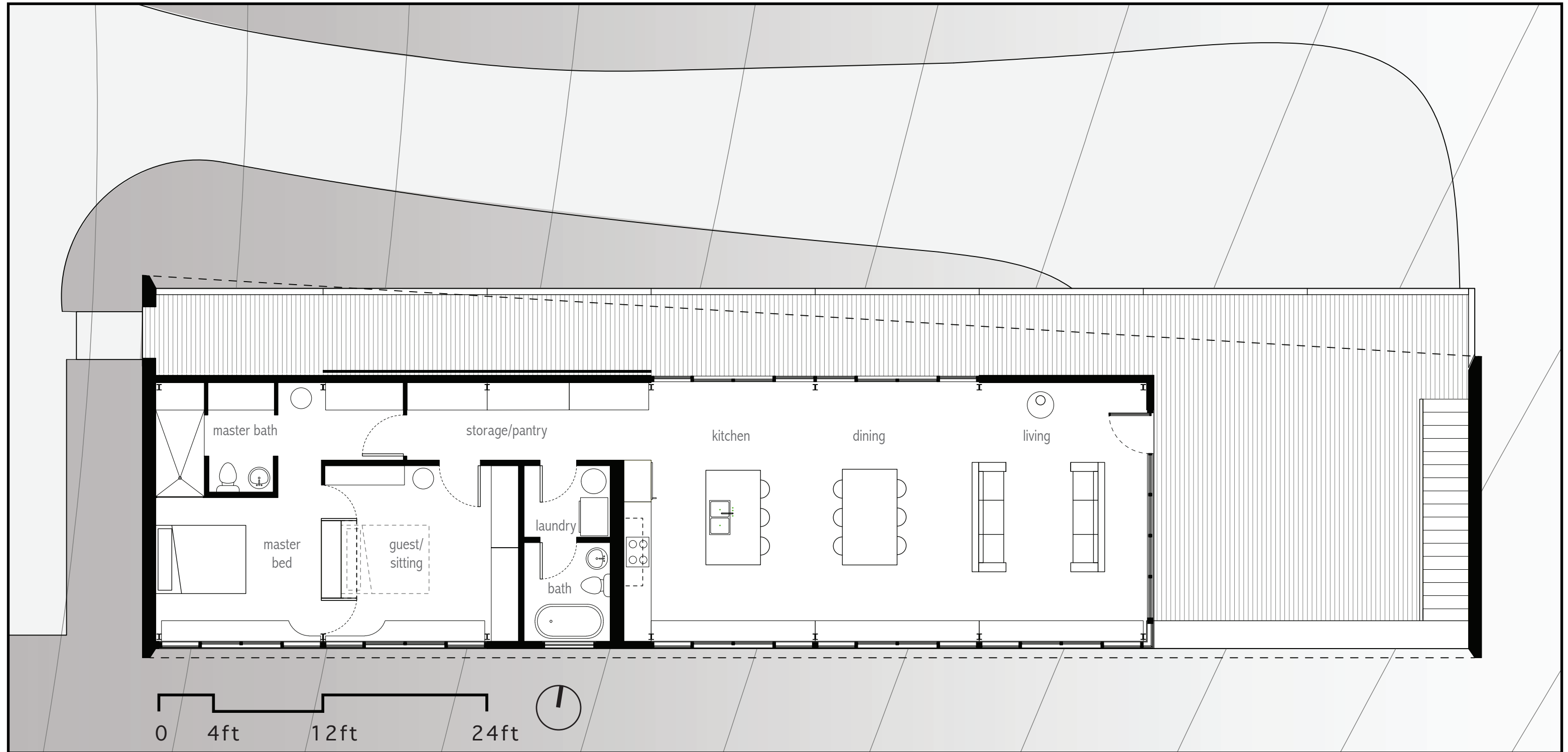
northern facade with deck

plan

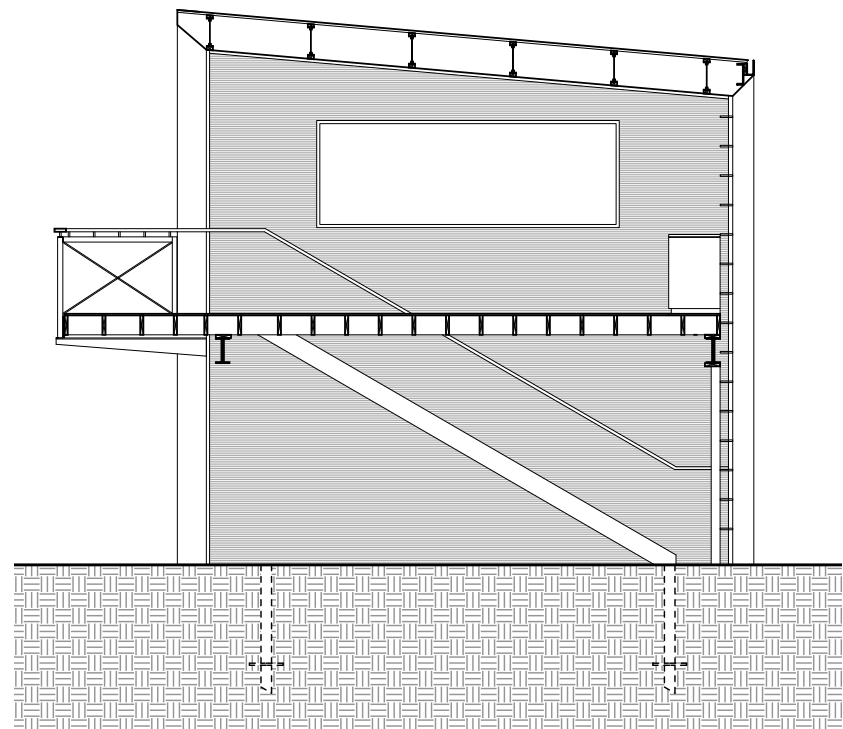
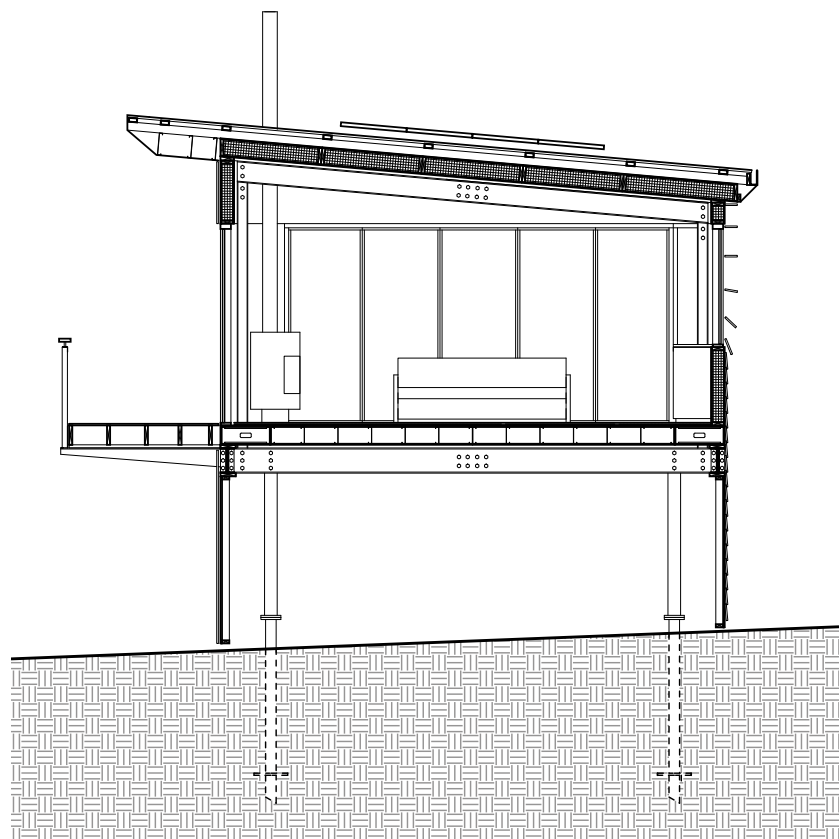
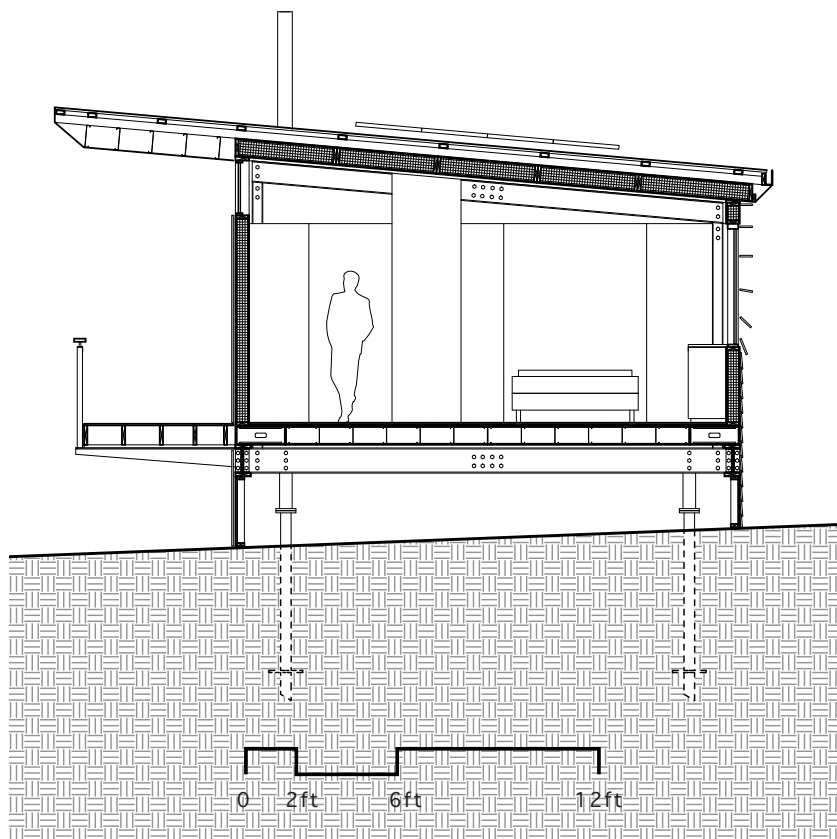
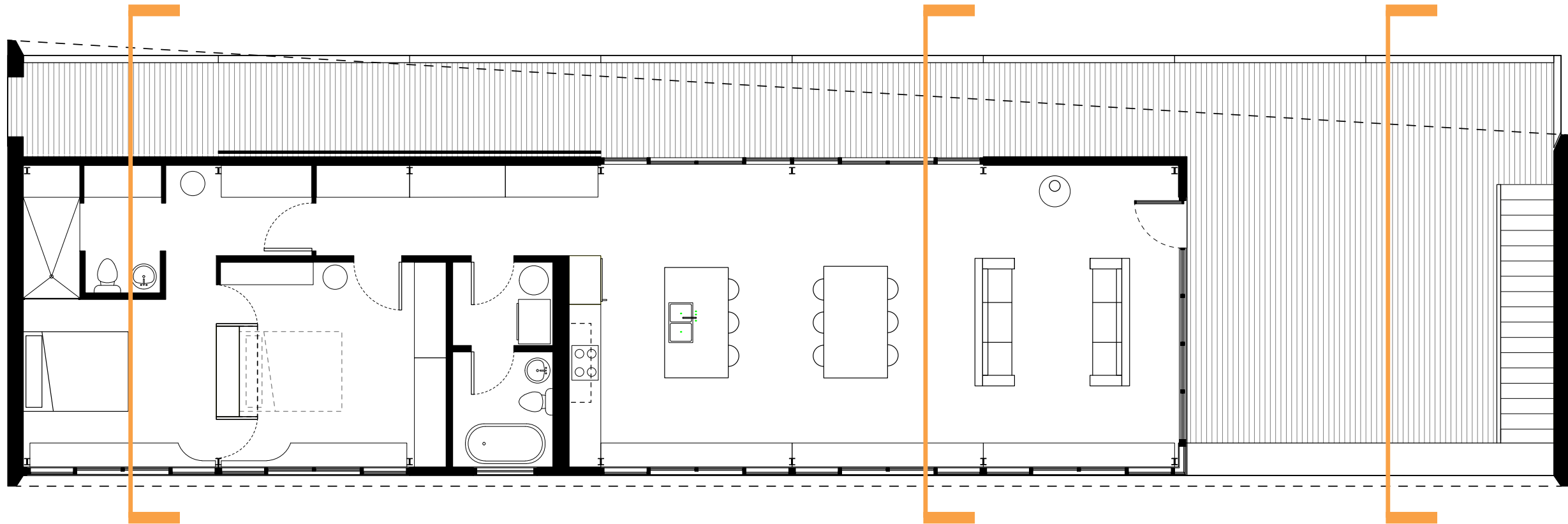


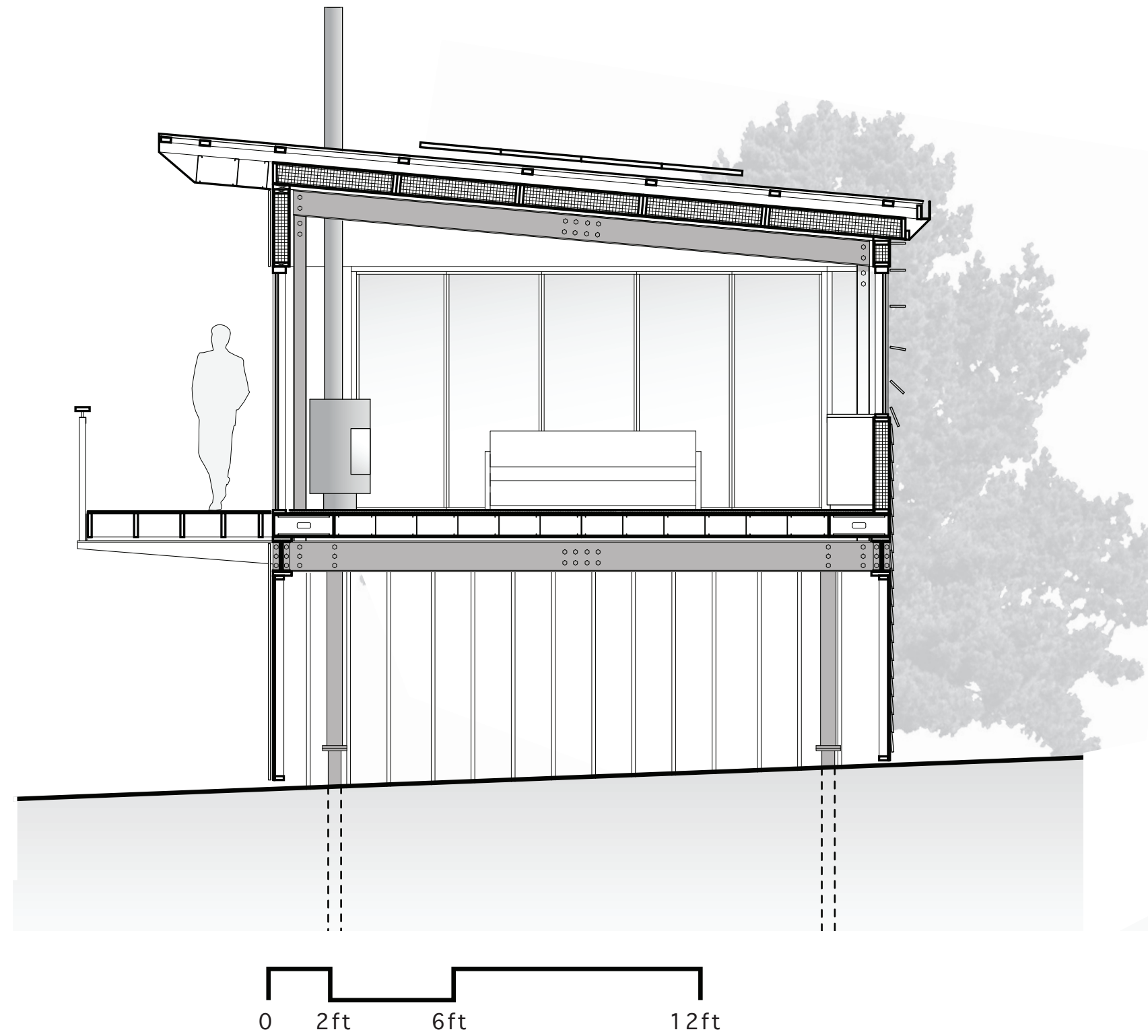
The formal organization of the plan is split between private and public by the central wet-wall. Due to the flexibility afforded by the steel structural frame this wall and the master suite bathroom wall are the only “permanent” interventions within the house, allowing for an extremely flexible plan.

plan

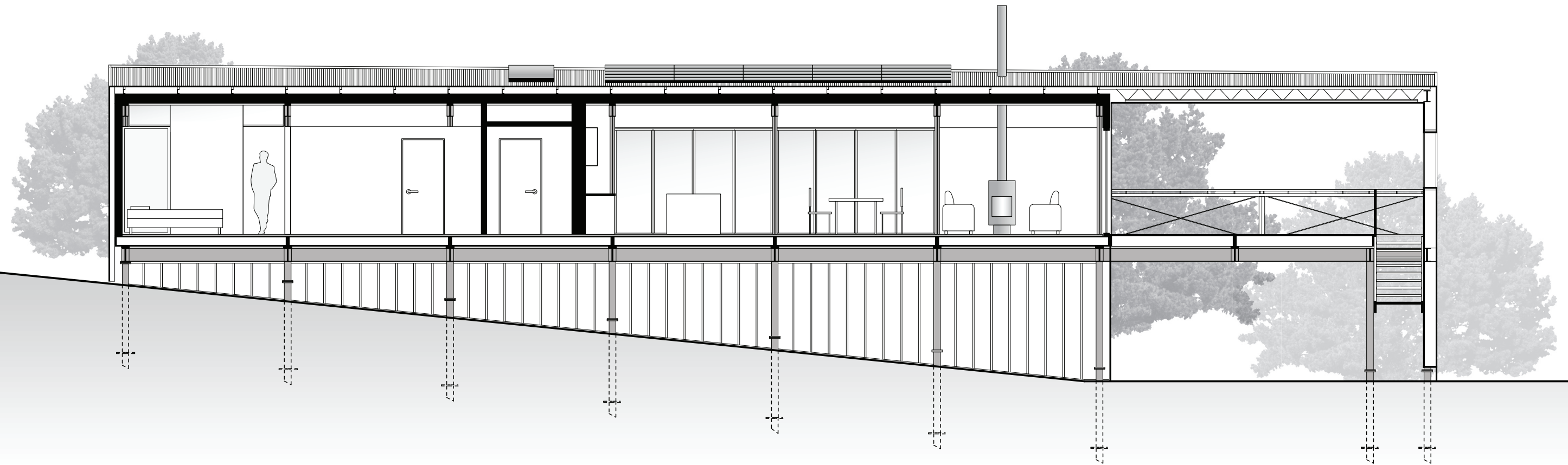
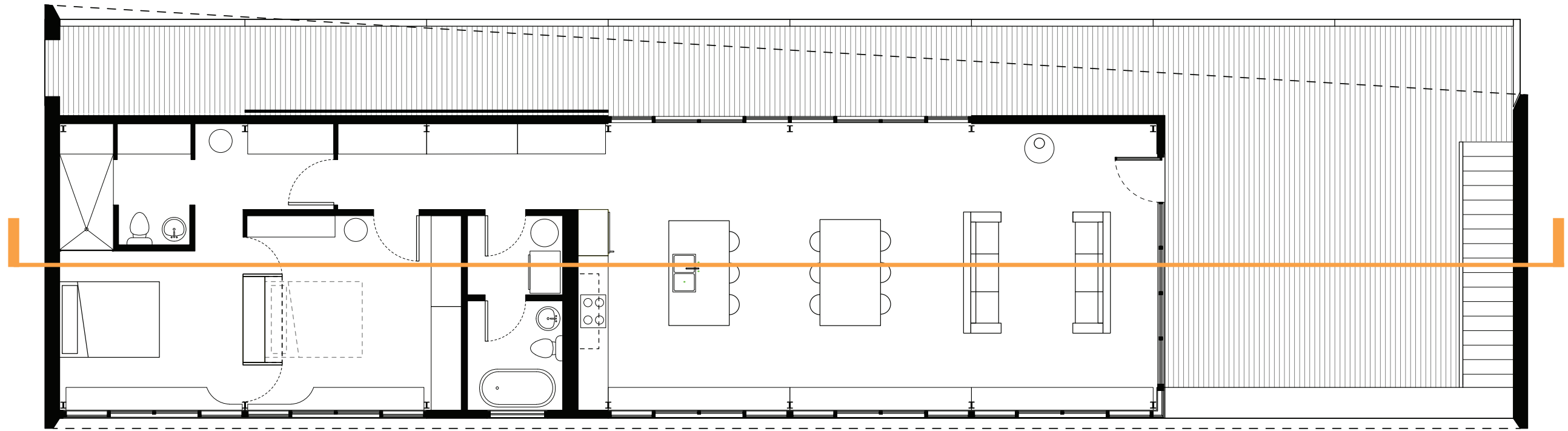


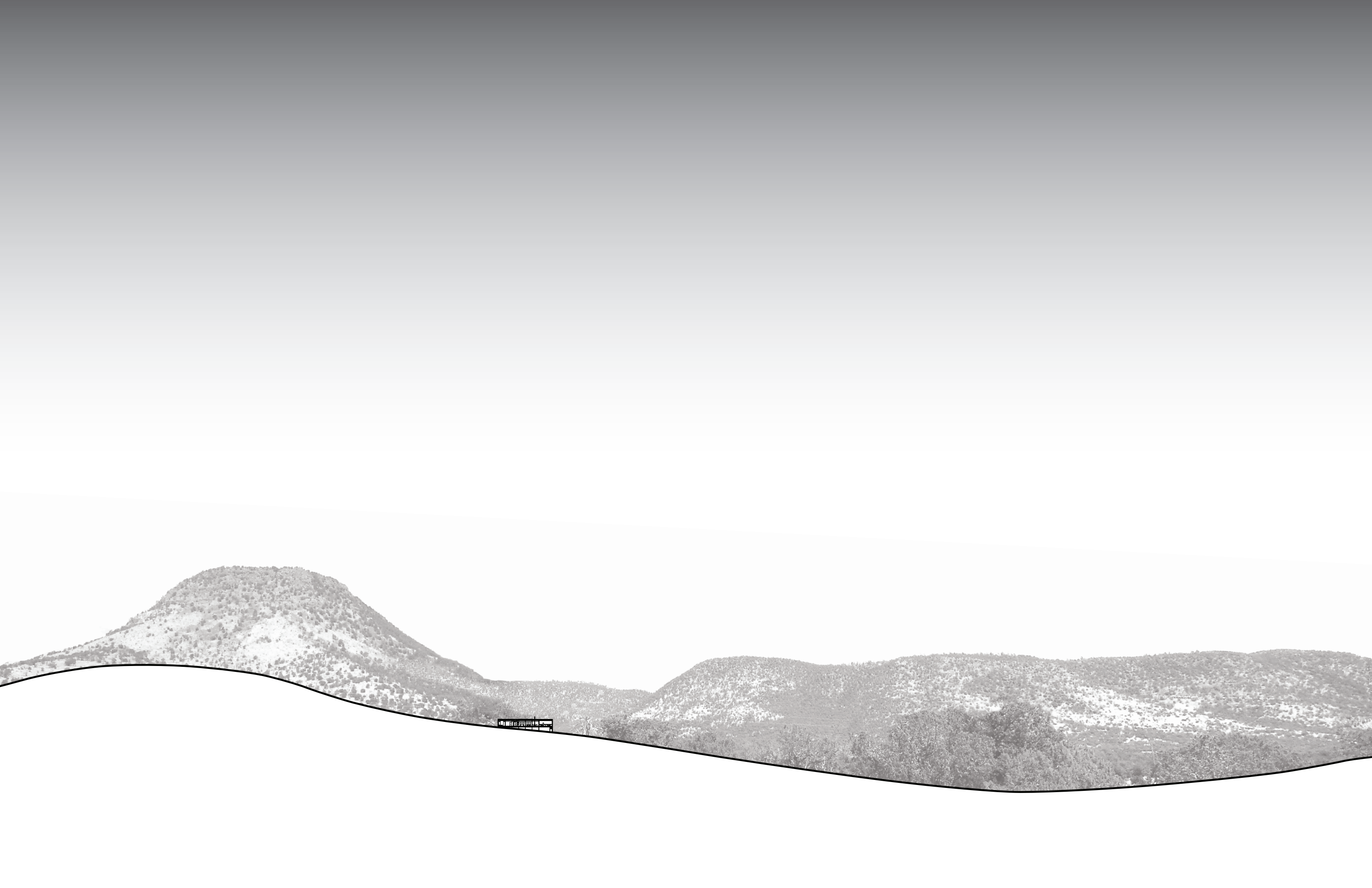
In this case the plan is organized into a master suite to the West that has an attached sitting room that can be converted to a guest room by closing the integrated doors and lowering the murphy bed within the large furniture wall. The mechanical, laundry and main bathroom are contained within a centralized service core. The eastern half of the house is an open plan that contains the kitchen, dining, and living room, with an outdoor room the living space can expand to include.



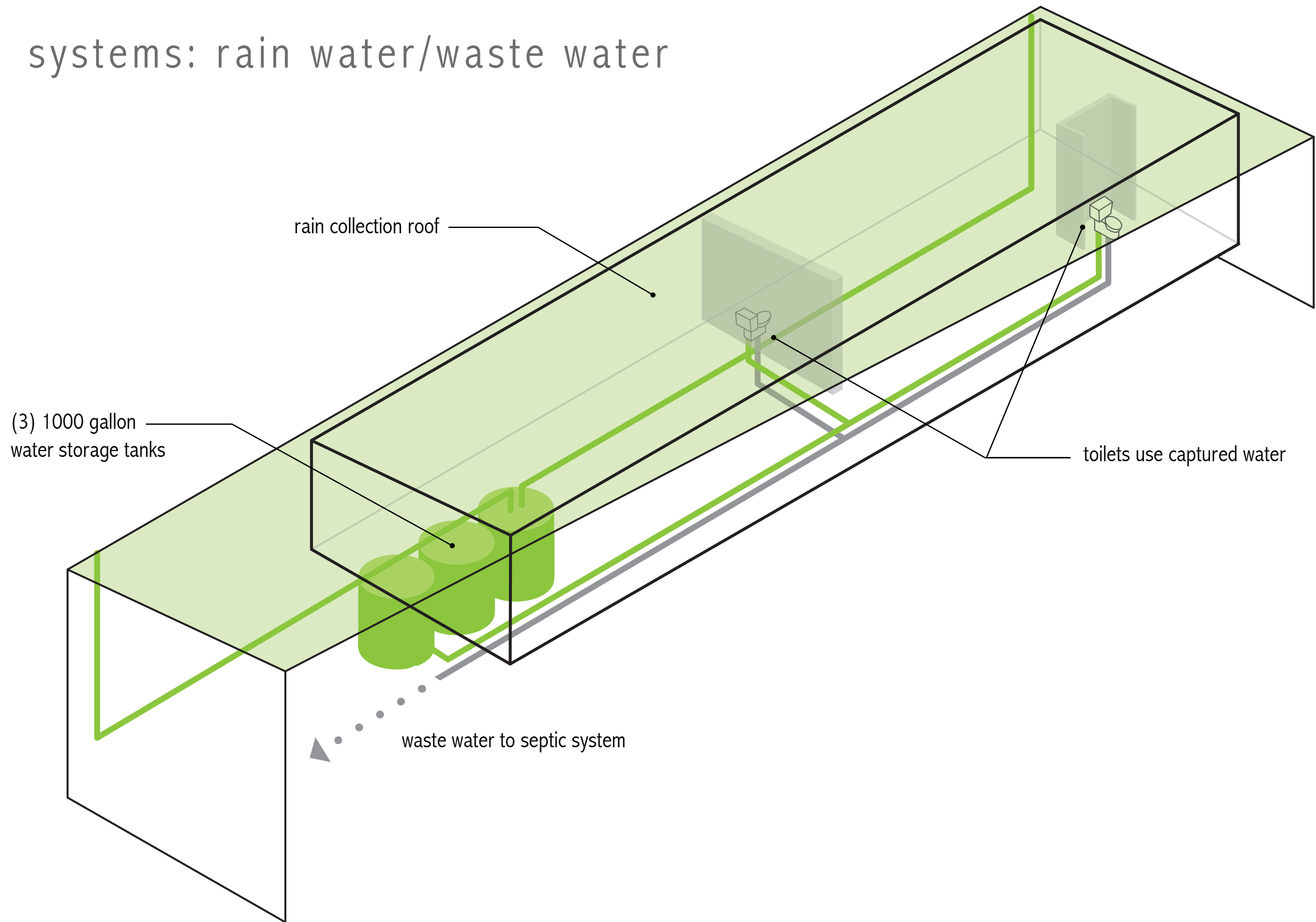




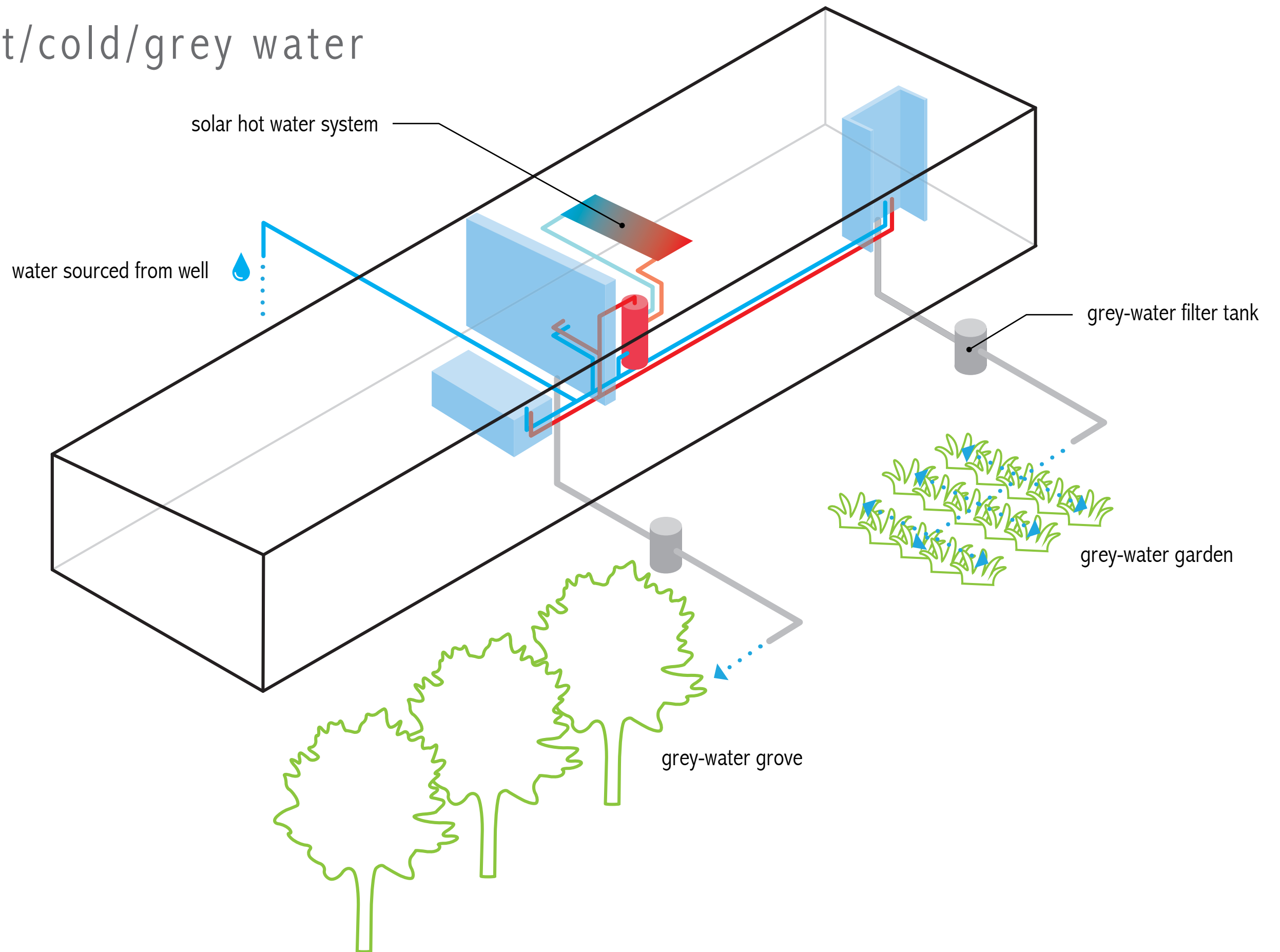




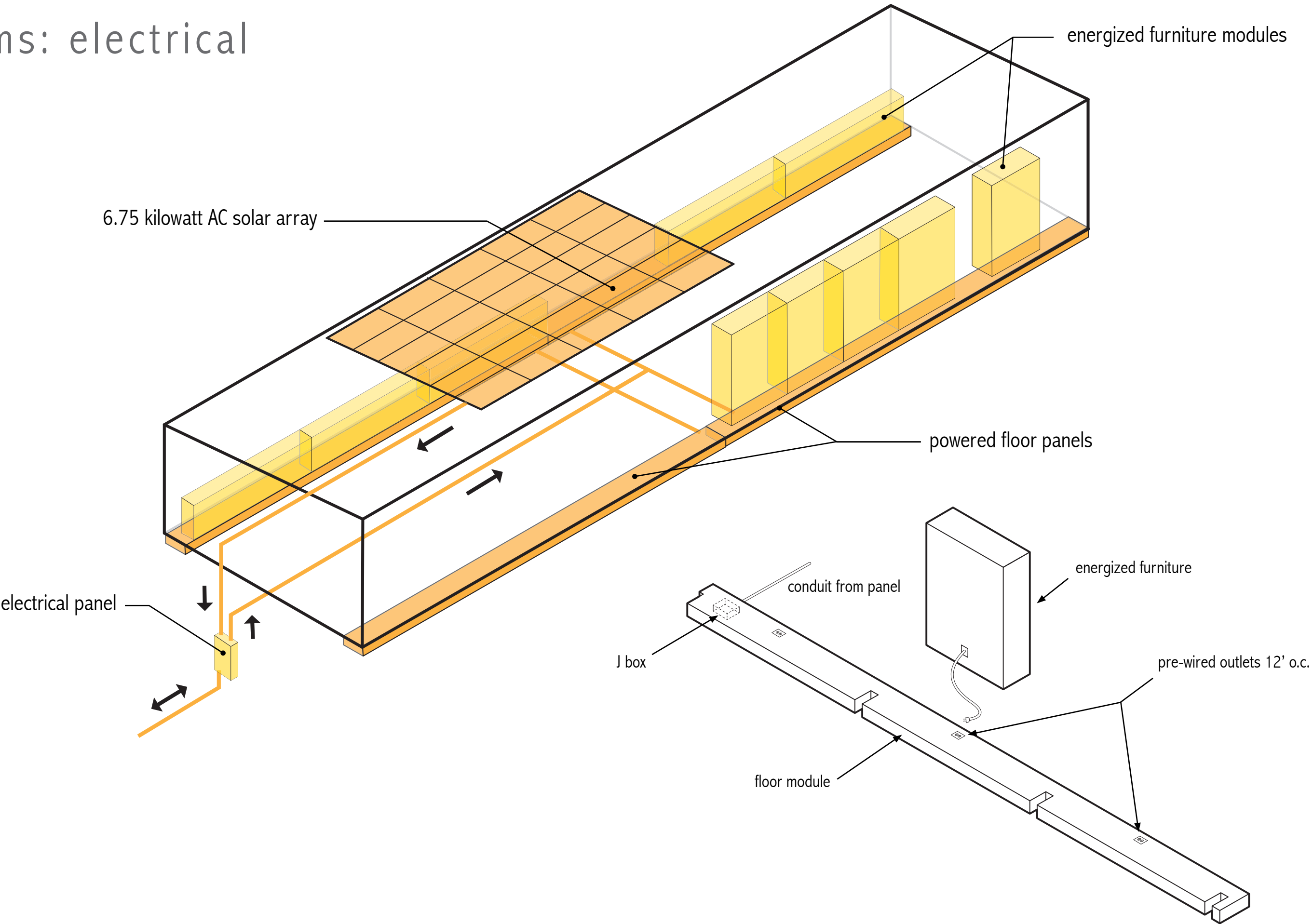
systems: rain water/waste water



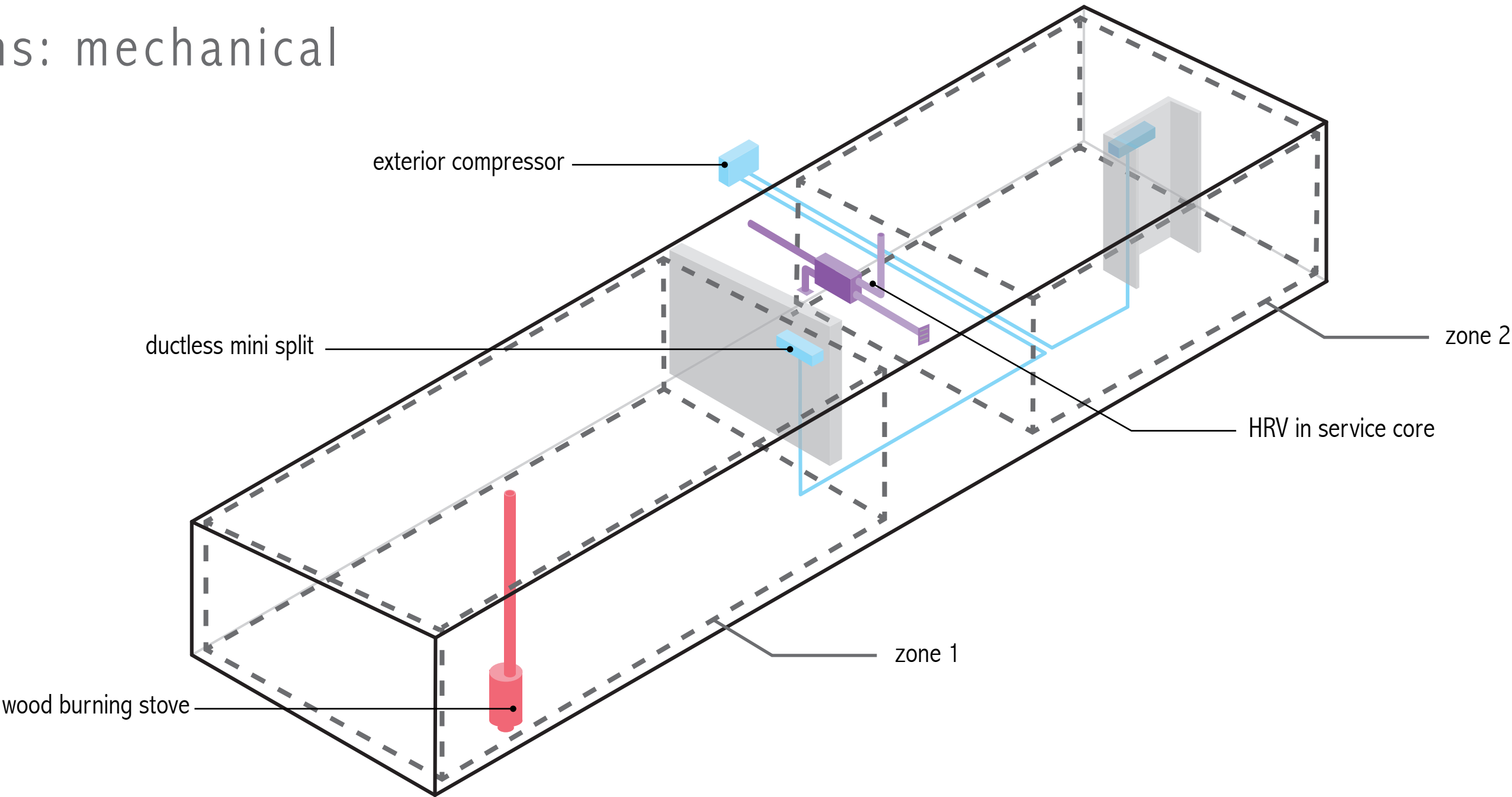
systems: hot/cold/grey water



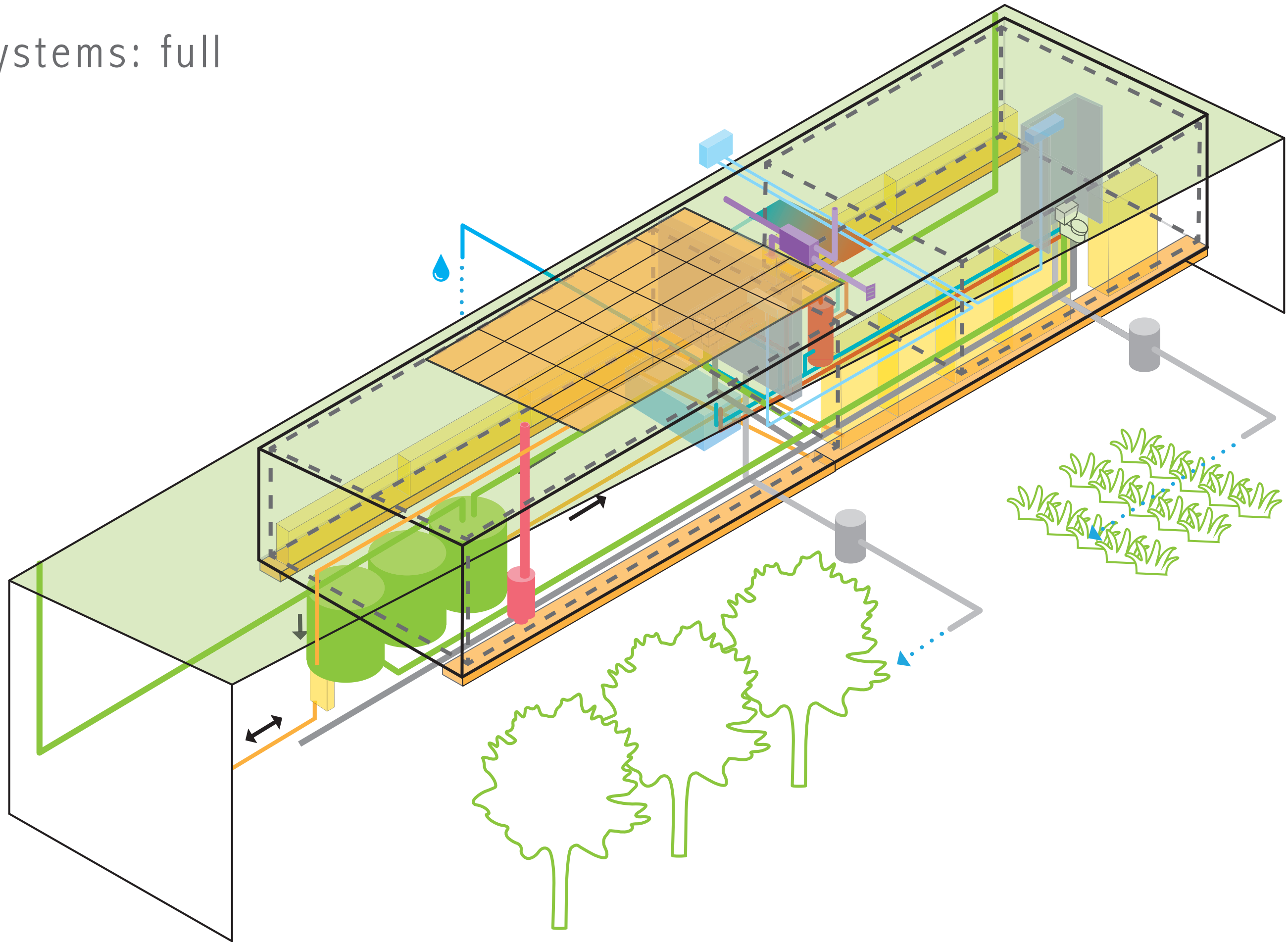
systems: electrical



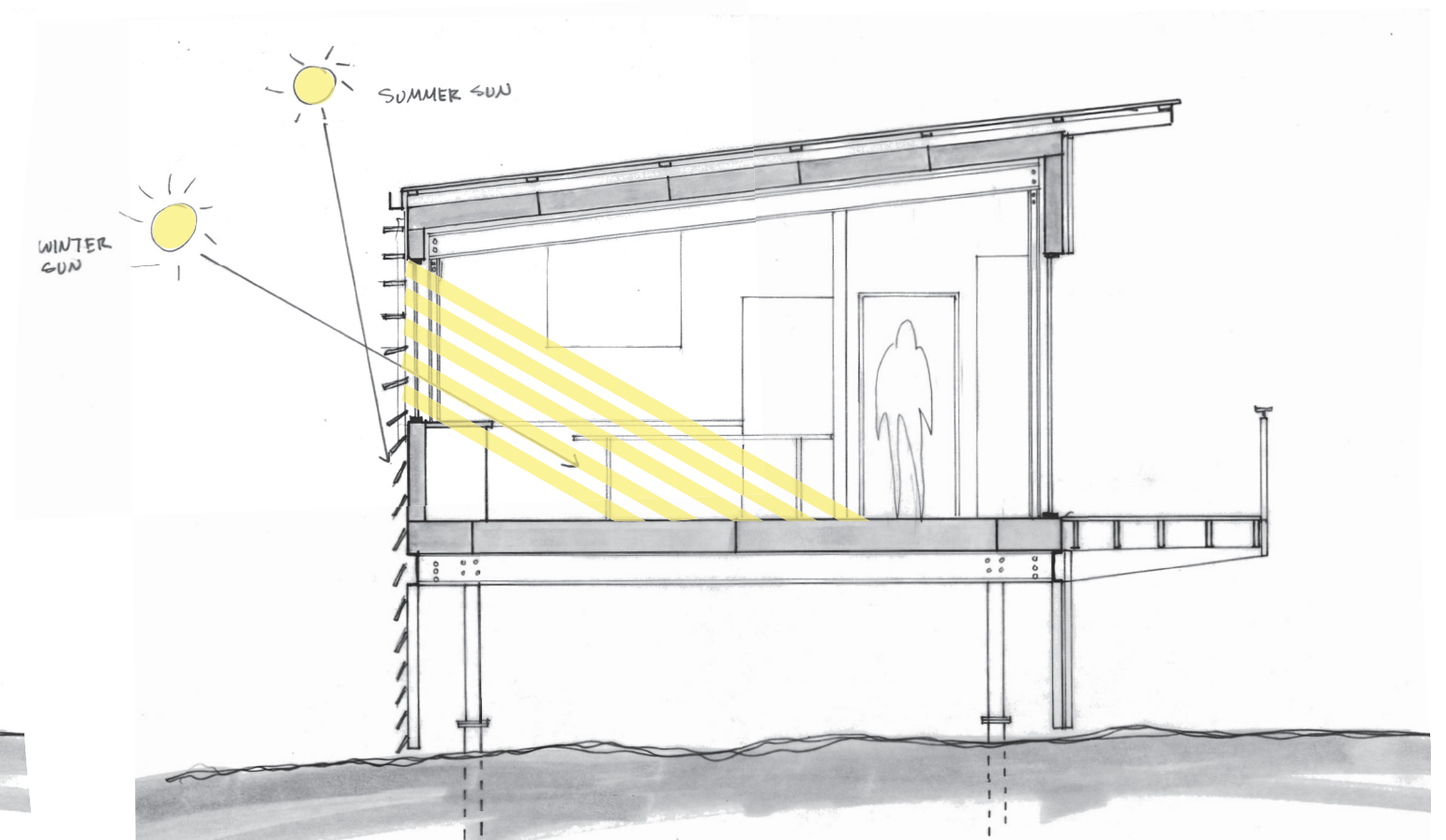
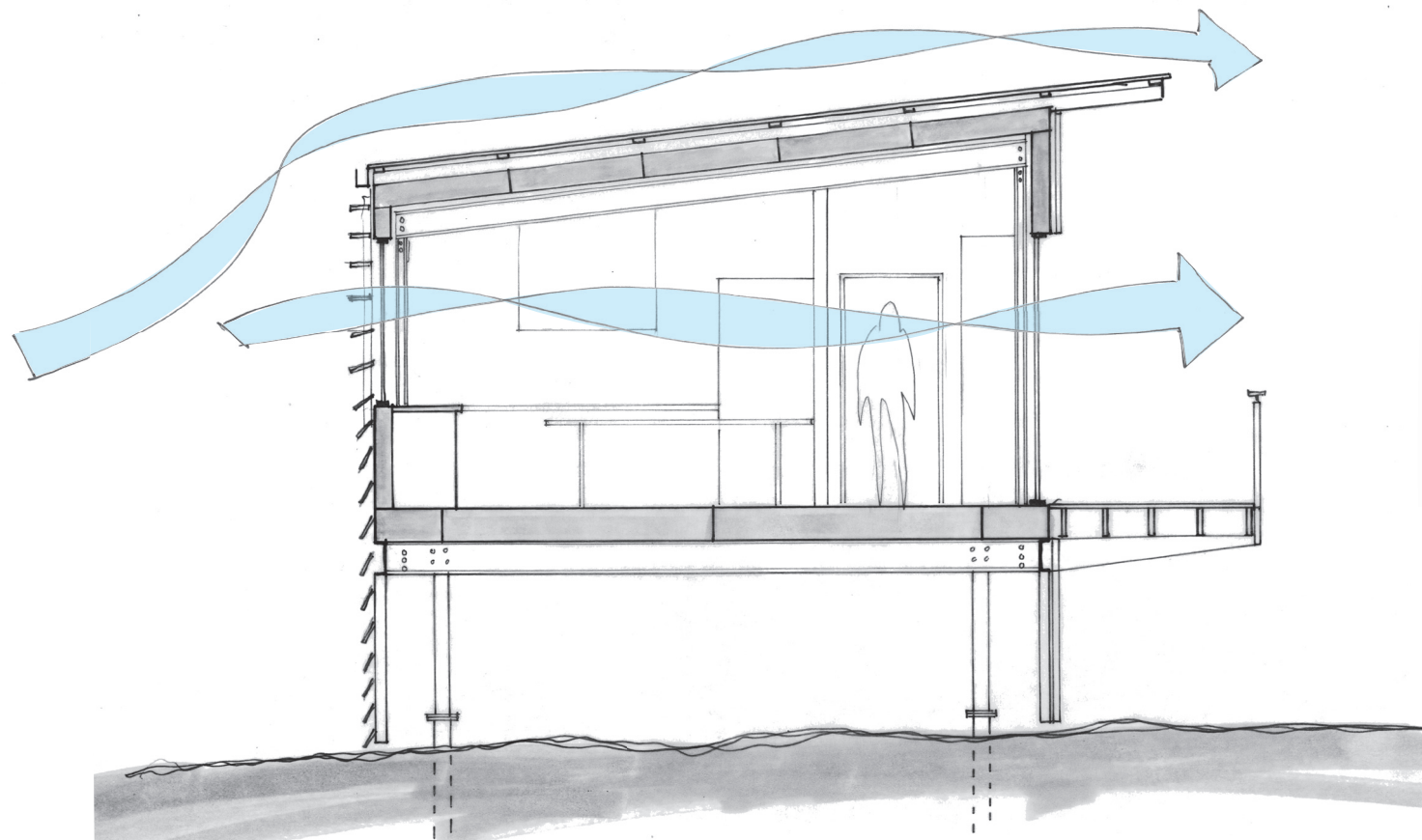
systems: mechanical



systems: full

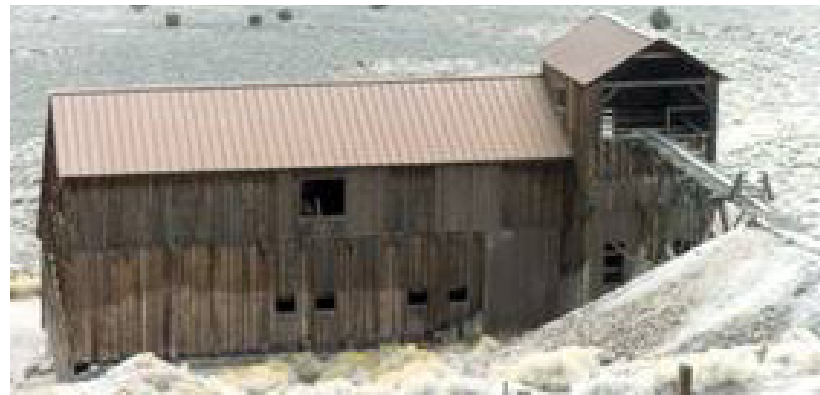


passive strategies



The house turns it back to the southern winds coming off the salt plains in order to minimize uplift and provide protection for the northern deck. However, on relatively calm days this orientation also allows the house to open both the southern and northern glazing bands to gain natural cross ventilation. Additionally, the horizontal siding of the southern wall pivots to become shade louvers when it reaches the glazing, and is situated in a way to block the southern sun but allow the lower winter sun to penetrate into the house.

feel



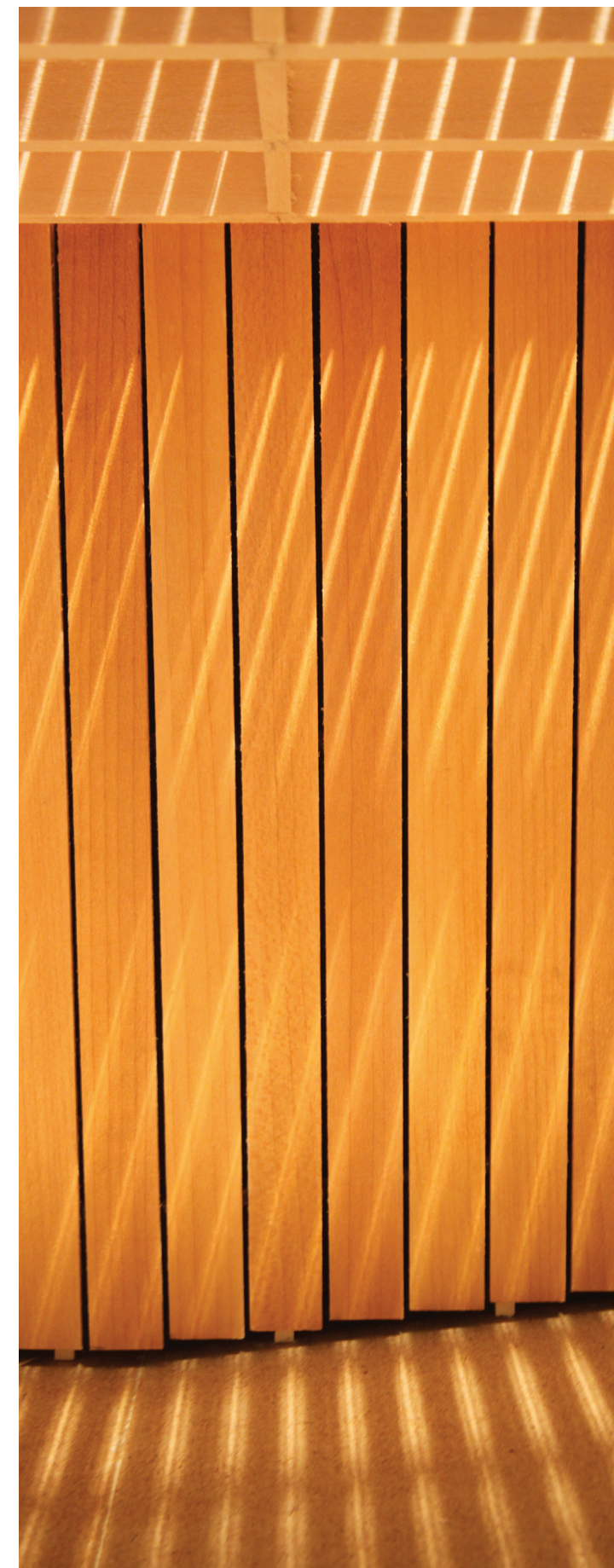
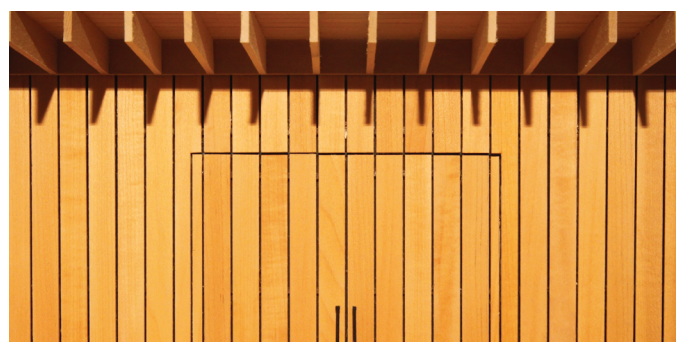
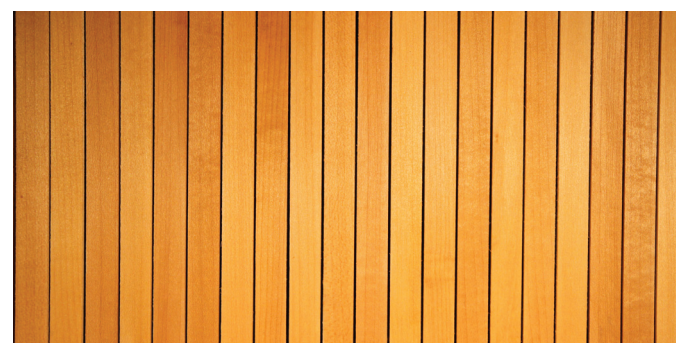
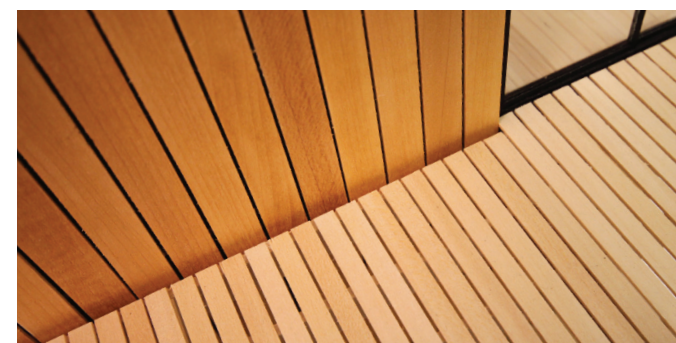
The aesthetic of the house references the rugged and honest construction seen historically across the high deserts of the southwest.















conclusion

The goal of this project was to create an organizational framework to expand upon with future projects in the southwest. I believe the linear frame, panelized enclosure, and light skinned strategy proved highly modular and flexible, enough that further iterations of the project will be an evolution rather than complete overhaul of the thesis. However, I am also interested in the inversion of the frame/panel relationship, and can see an exterior frame directly supporting the light skin and an interior panelized enclosure working as well. Additionally, an all-wood system should also be explored to compare against the steel frame system.

This entire project was constructed as a parametric or BIM 3D model in Revit Architecture. The benefits of using this powerful software typically used on large scale projects on a more modest construction are still very tangible and should be further explored in the future. In this case I was able to track the weight of individual components (important considering the construction method of the project), assign values and calculate embodied energy and the carbon footprint of those components, and even track theoretical costs. I believe using these tools can empower both architects and clients to better understand potential designs and modify them for optimal performance before they are even built. These tools can re-classify the architect as both designer and builder.

Questions about the relevance or even the ethics of designing ground-up construction for such remote areas have been raised regarding this project. In an era of increasing resource depletion and sprawl these questions are healthy and well founded. However, the reality is that throughout the rural southwest (and similar areas throughout the country) towns and villages exist and have existed for many years as self-contained communities with large land parcels. This project could serve to replace the numerous ill conceived buildings that populate these towns, from out of place copy-cat suburban homes to poorly constructed and deteriorating mobile homes. Additionally, the Native American community, widely dispersed across numerous Reservations, is in dire need of quality housing solutions. I believe the Remote Home system, with its modest but solid organizational and economic underpinnings and wide flexibility, could be used to provide quality housing in all of these cases. This would in fact reduce long-term resource consumption and increase the quality of life in these areas at the same time.



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A comprehensive look at the residential work of Pritzker Prize winning architect Glenn Murcutt. This book has large photographs and plans of the various houses, commentary by the editors and descriptions by Murcutt for each project. Murcutt's specialty is regionally and environmentally sensitive homes that typically employ passive systems and local material. Most of this buildings are sited in arid regions around Australia. He also incorporates ideas of re-use, mobility and recycling of his buildings.

Schwartz-Clauss, Mathias and Alexander von Vegesack. **Living in Motion: Design and Architecture for Flexible Dwelling**. Weil am Rhein: Vitra Design Stiftung gGmbH and contributors, 2002. Print

A collection of projects having to do with “mobile” or modular living. The projects reviewed range for the historical to the completely conceptual, and include pieces that could be described as art, furniture, installation and even architecture. It includes extensive pictures and illustrations and essays by contributors grouped by topic. This print was published after a similar exhibition at Vitra.

Quantrill, Malcom. **Plain Modern: The Architecture of Brian Mackay-Lyons**. New York: Princeton Architectural Press, 2005. Print.

A monograph of Brian Mackay-Lyons work, including residential, commercial and studio-based “Ghost Studio” projects. Each project has multiple pages of annotated pictures and drawings, along with project descriptions by Mackay-Lyons. This work is considered both regional (northeast Canada) and sustainably oriented. Mackay-Lyons has multiple restricted budget, remotely located houses that he employs a number of strategies to complete. These include prefabrication, material choice and local labor considerations. He also uses a number of passive strategies. There is also a foreword by Glenn Murcutt.

Peters, Nils. **Jean Prouvé**. Cologne: Taschen, 2006. Print.

A monograph of Jean Prouvé's work chronologically presented. The type of work described ranges from furniture design, single family homes, pavilions, commercial and multifamily residential. Each project has an explanatory essay accompanied by annotated drawings and photographs. The book highlights Prouvé's interest in efficient, low weight and low cost metal designs and his proficiency as designer and engineer. It contains multiple examples of factory built and prefabricated pieces, including single family homes.

Davies, Colin. **The Prefabricated Home**. London: Reaktion Books Ltd, 2005. Print.

This book is a commentary on the success and failures of attempts at prefabricated housing. Davies takes a very critical stance on the failings of numerous, well-known architects and attempts to explain how and why each “architectural” endeavor fell short of their intended goals. He also looks at why the “mobile home” industry has been so successful and what the architectural community can learn from its example. Davies is dubious of architects' tendency to relate the automotive and aerospace industry with the housing industry, but ultimately finds advancement in computer aided manufacturing as a solution to the issues of customization and tolerance inherent in house design.

Bergdoll, Barry and Peter Christensen. **Home Delivery: Fabricating the Modern Dwelling**. New York: The Museum of Modern Art, 2008. Print.

An illustrated catalogue of the identically named exhibit at MoMA in 2008. Typically each project is given one to two pages containing an explanatory text and multiple annotated images that include drawings, models and construction photos. The range of projects spans the history of prefabricated housing, with many styles and countries represented. There are also five projects specifically commissioned for the exhibition that are covered in further detail. These projects highlight new and novel technologies for implementation within the prefab housing industry.

Kieran, Stephen and James Timberlake. **Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction**. New York: The McGraw-Hill Companies, 2004. Print.

The Principals of Kieran Timberlake take a critical analysis of modern architectural and construction methodologies. Specifically, they explore how proper design and manufacturing could speed construction and reduce cost and waste over current practices. There is a heavy emphasis on pre-manufacture philosophies and current (failing) best practices, and many references to the successful Automotive and Aerospace industries, illustrations are basic and mainly diagrammatic. The latter portion of the book has many current architectural examples of pre-fabrication and a series of new best-practice suggestions.

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