

# Wind Winders

## Boomerang Gardens

Client: City of Weymouth  
Project: Summer Camp  
Location: 10 Patriot Pkwy, Weymouth, MA

10 PATRIOT  
PKWY

Date: 05-17-24  
Designer: Jacob Barbarossa, M.Arch



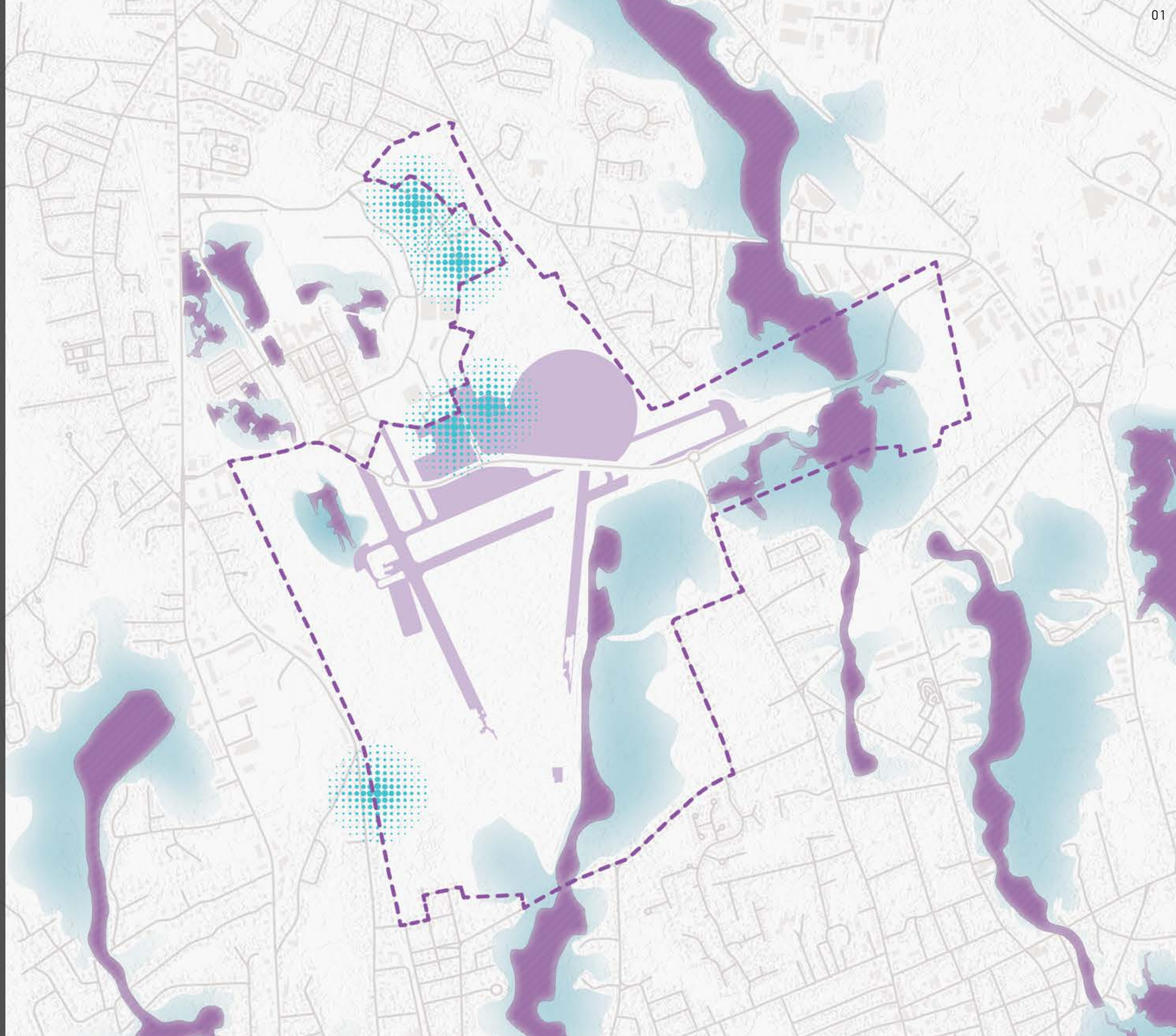
# Site Overview

Boomerang Gardens, formerly known as the South Weymouth Naval Base, served as a naval air station for the United States since 1942. During the terrors of World War II, the site was a critical defense against submersible threats and boasted an impressive fleet of blimps and aircraft.

Over 80 years later, with AUL dump sites scattered across the site and the pollutants from decades of aircraft exhaust have created a crisis in the soil. The pollutants are slowly decaying the site into a wasteland where the extremely acidic soil will soon be barren.

Unbeknownst at the time, the site is now home to rare wetland and aquatic species. Ignorant to their impending downfall, the future of these species is now in jeopardy as the years of soil contamination and lack of nutrients have created an environment that will soon be uninhabitable. Without food and shelter, the local rare species will be forced to migrate or face an uncertain future of hardship and struggle.

-  AUL Dump Sites
-  Core Habitats
-  Buffer Zones
-  Hardscapes

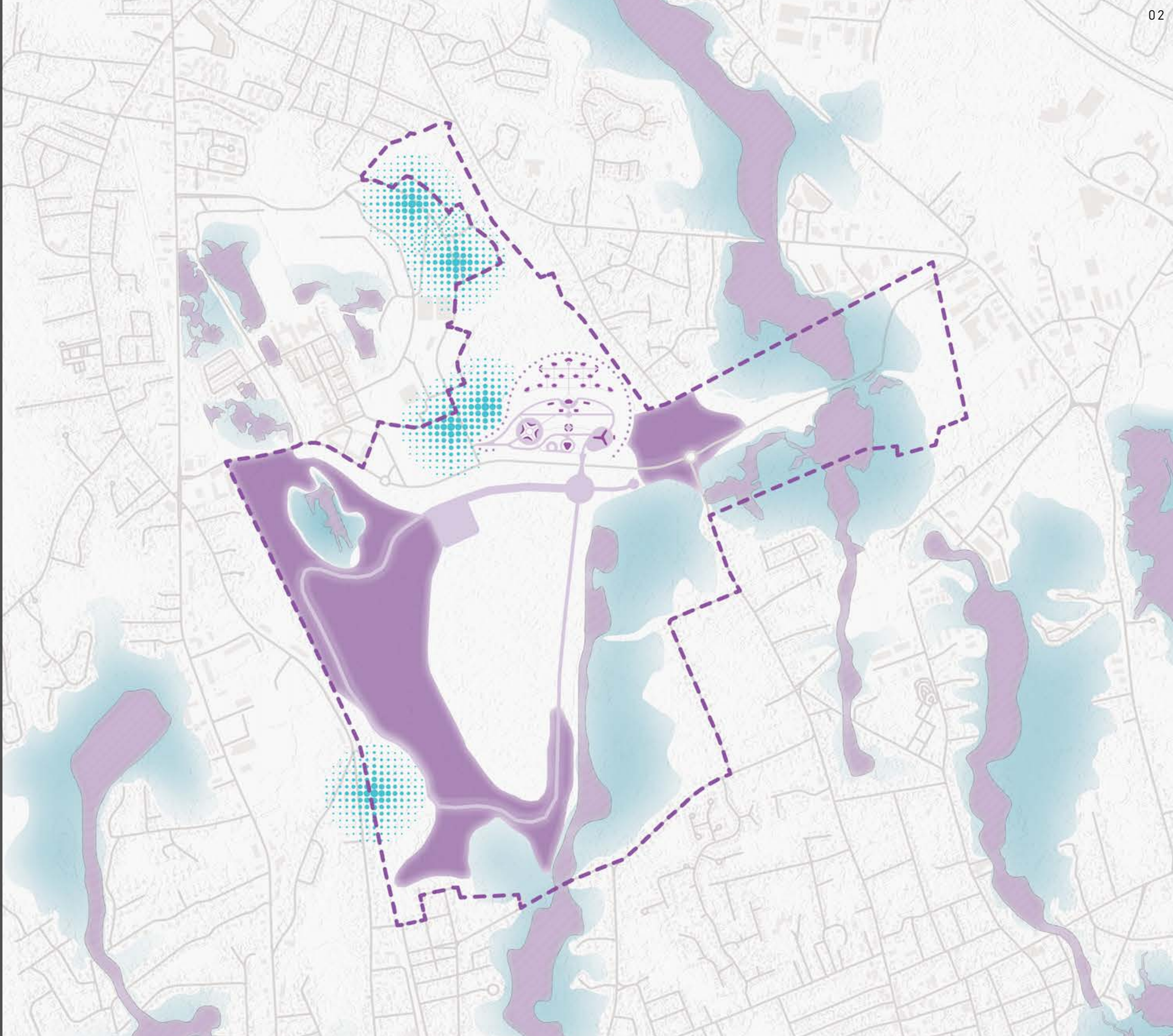


Site Solution

By introducing an abundance of native acidophile life such as blueberry bushes, we can bring back the life at Boomerang Gardens. Acidophile shrubs and trees are hardy species that can thrive in very acidic environments, bringing new growth and a promised future to the site. When the leaves and berries fall to the ground, the organic matter from the acidophiles decompose and absorb into the soil, generating healthy nutrients for continual growth. Slowly healing the years of neglect the site has endured.

By planting acidophiles in strategic positions within Boomerang Gardens, over 2,000,000 square feet of regrowth zones will separate the habitats from heavy contamination and the footprint of society. The regrowth zones will create a safe space where the local species can wander and expand upon their habitats. Creating an ecosystem that promotes future growth. Utilizing safe aggregates, the site will feature hiking trails around these zones that allow the communities of Weymouth to enjoy the natural environment of Massachusetts.

-  AUL Dump Sites
-  Core Habitats
-  Buffer Zones
-  Regrowth Zones
-  Aggregates



////////// Cabin Concept

**Concept:**

After analyzing solutions to revitalize the sites ecosystems, the concept of the proposed Boomerang Gardens cabins must be focused on reducing the carbon footprint of the construction process while respecting the surrounding area. Featuring structures that do not harm the delicate habitats found within.

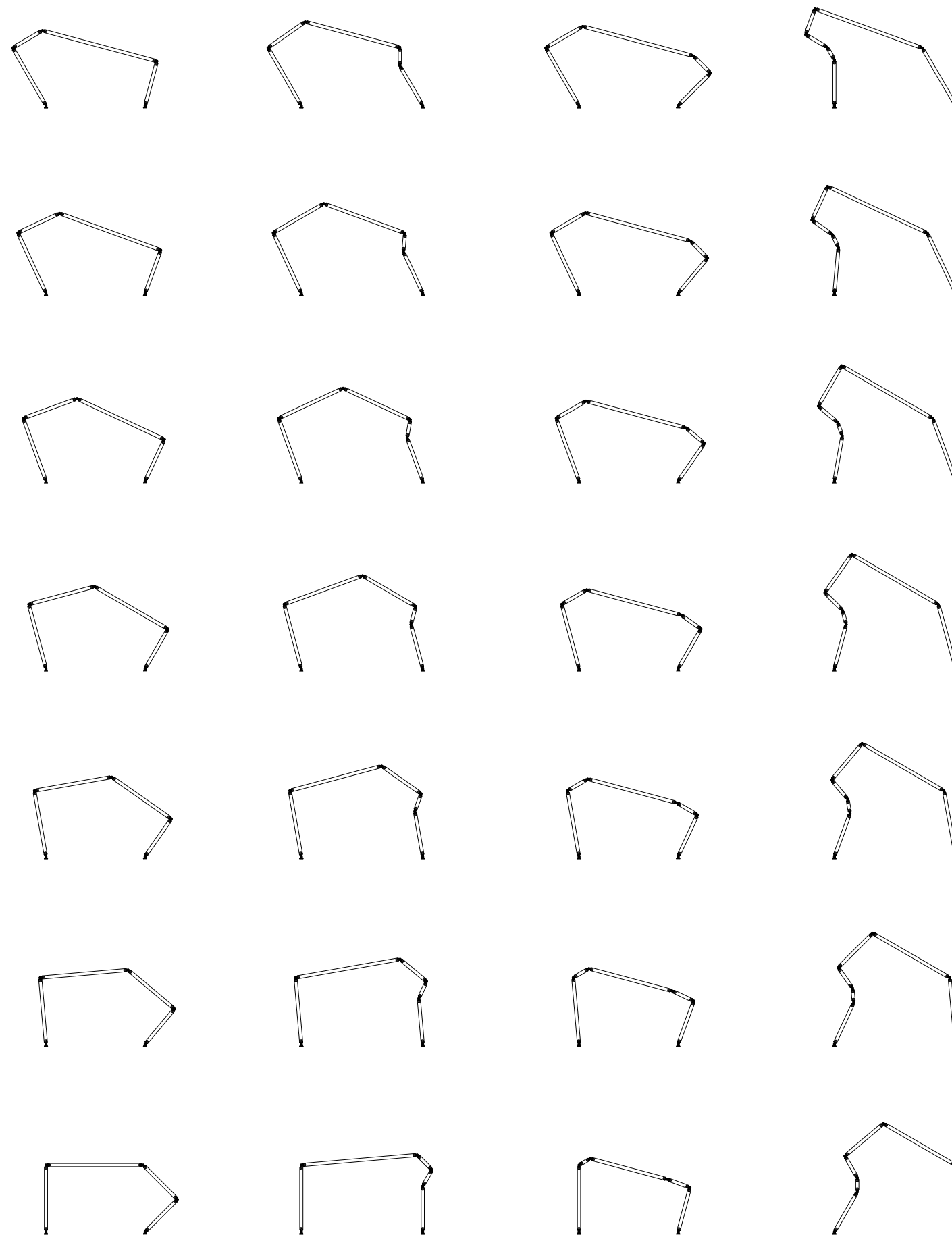
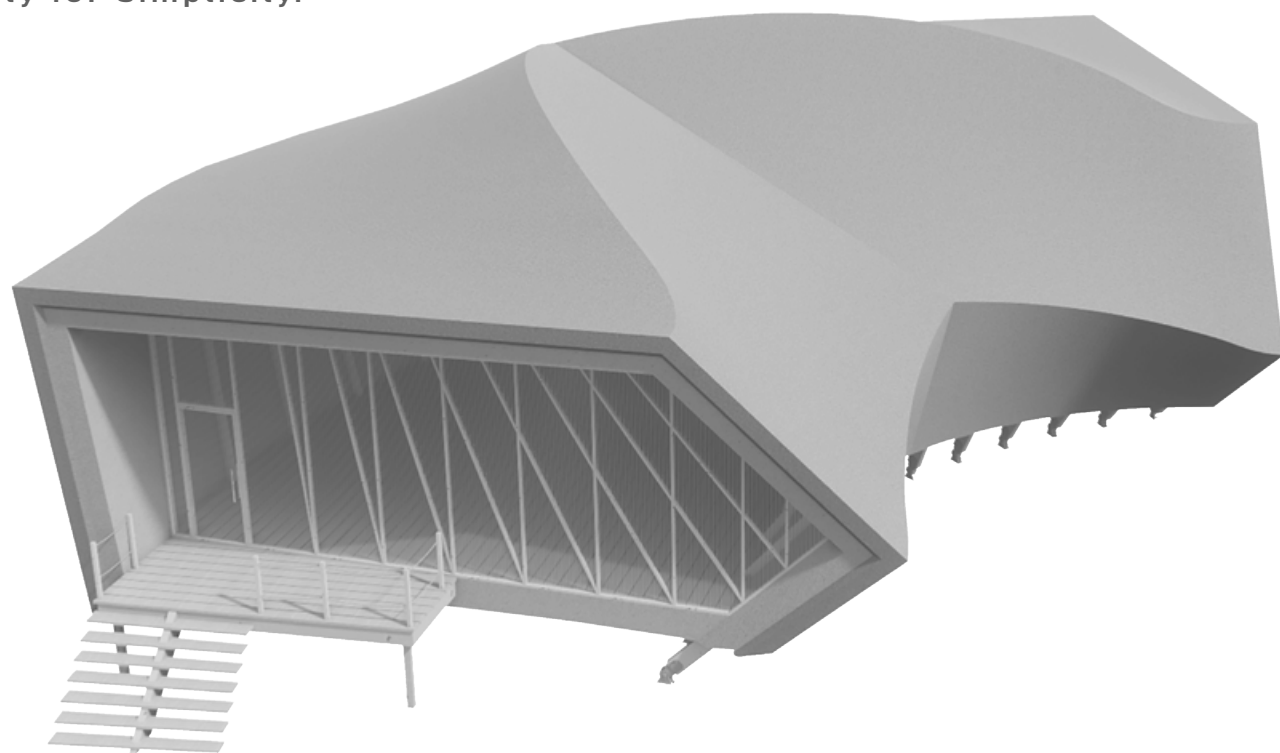
A simple way to protect the surrounding environment is by reducing the need for mechanical. The site will benefit from harnessing wind in the occupied period from June to September. Eliminating the carbon emissions found in most air conditioning systems.

In addition, the cabins must abide by a simple construction process as to eliminate as much need for heavy equipment as possible. Allowing staff members to easily erect the cabins without special machinery.

The cabins will harness wind, be simple to construct, and utilize green building materials. They will be the product of modern day design principles merged with old building practices. Mixing old with new in a fashion that can create an efficient green structure.

However, merging a complex geometric structure able to capture wind, with a simple construction process will not be typical. These "Wind Winders" must set fourth a simple yet repetitive set of parameters that can be achieved with little experience in the construction field.

**Complexity for simplicity.**



Wind Analysis & Function

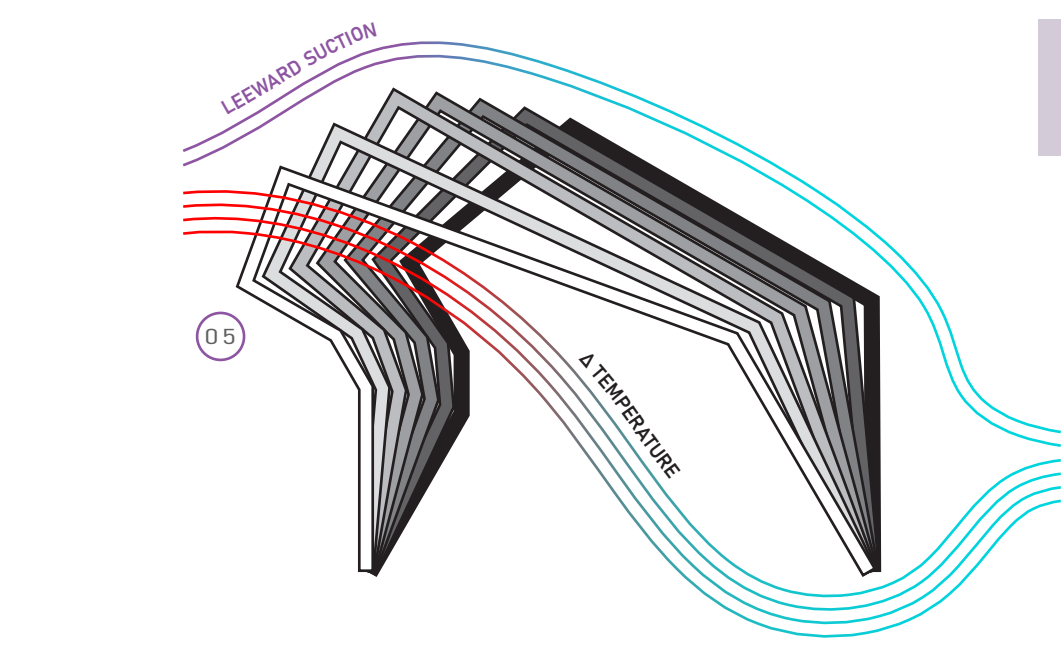
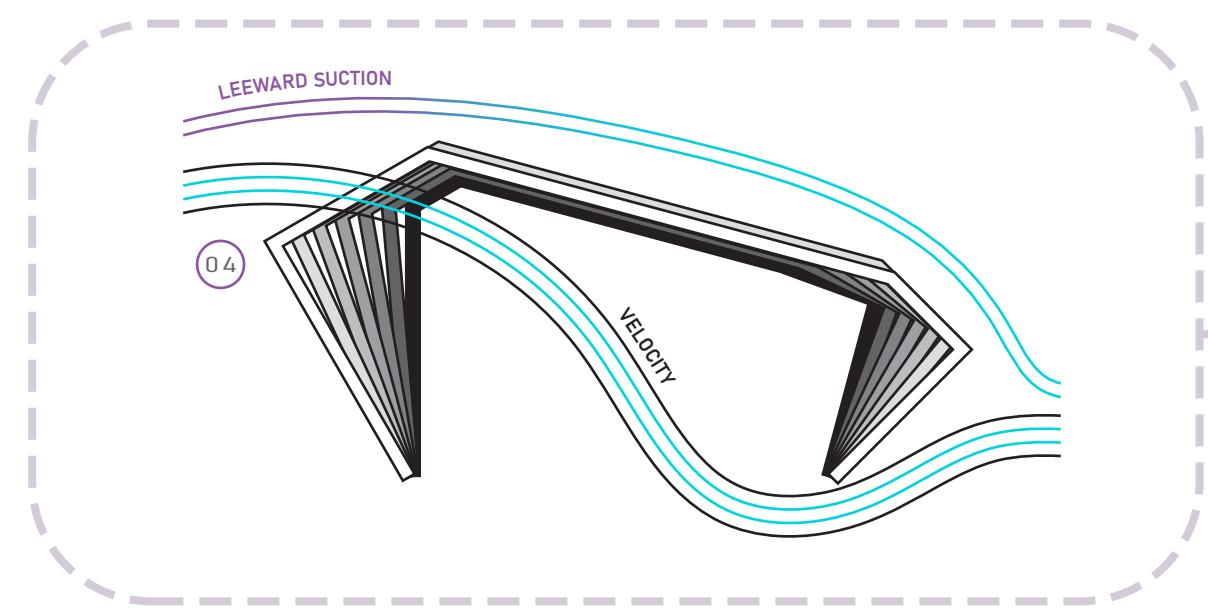
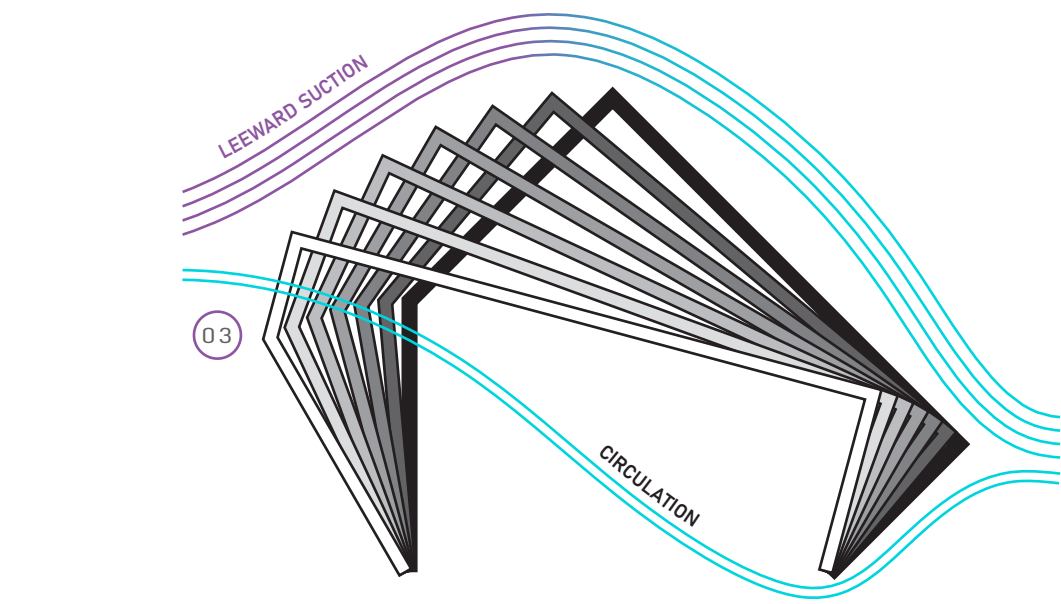
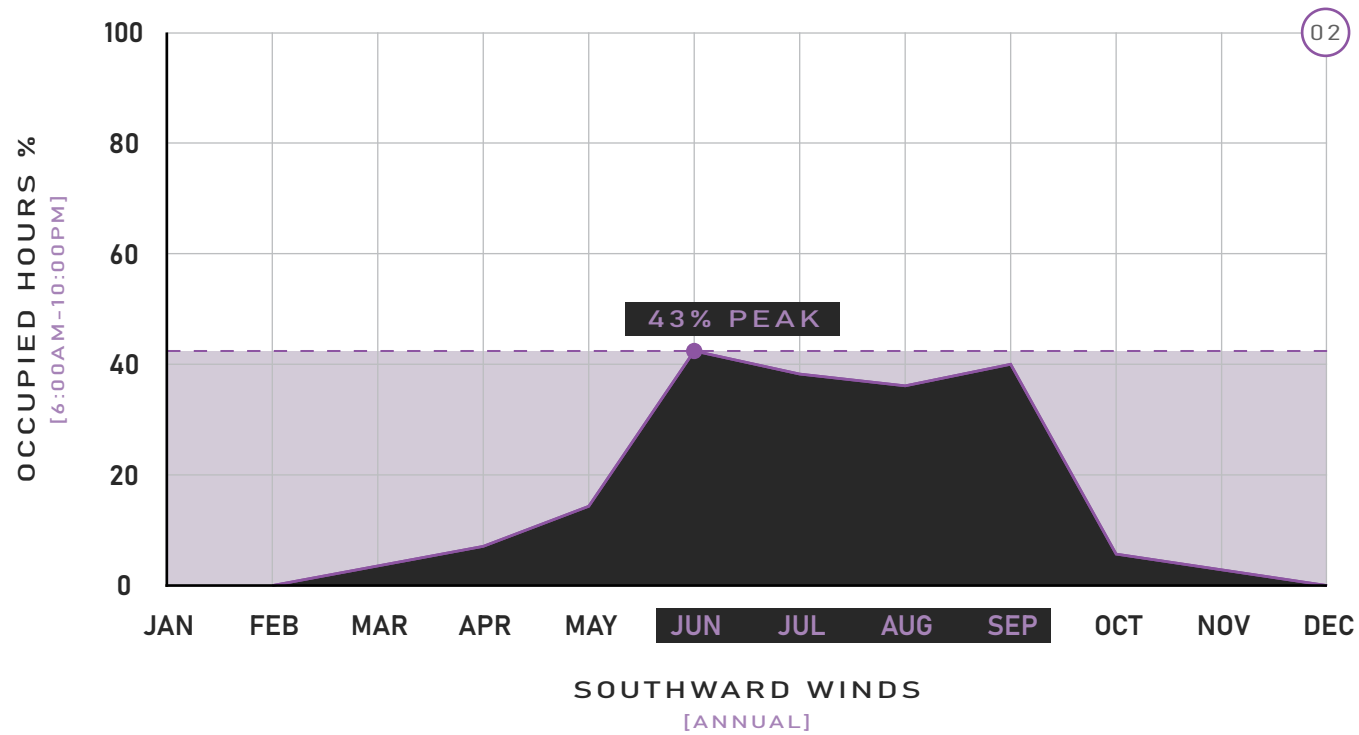
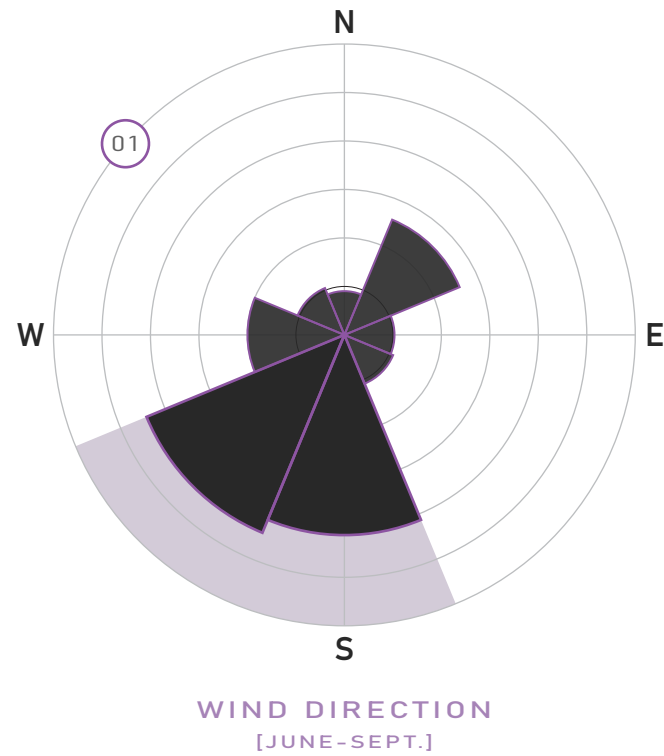
**01 Wind Direction**  
 Showing the average wind direction in South Weymouth during the summer months. The highlighted zone shows the preferred orientation of the proposed design.

**02 Occupied Hours**  
 This graph correlates to figure 01, showing the percent of occupied hours against the southward winds, reaching a peak of 43% of the cabins occupied hours.

**03 Method 01**  
 Designed to amplify the leeward suction that occurs due to negative pressure. This suction will help aid the positive pressure through the structure, circulating fresh air.

**04 Method 02**  
 A splitting windward face and low building height, allow for a steady wind velocity by ramming air through the structure with minimal resistance. Aiding in the buildings internal temperature.

**05 Method 03**  
 Featuring a wide base and a tapered spout, this design is able to guide the incoming winds up and out of the structure. While the temperature of the air warms, the chimney effect of the structure guides the air up towards the leeward suction vents.



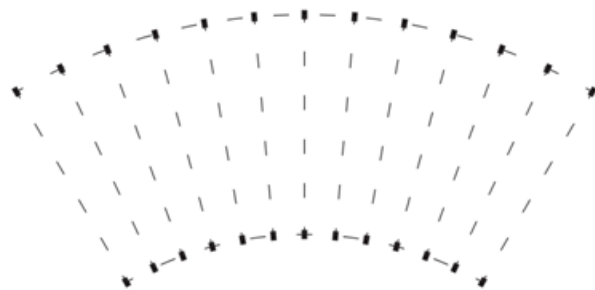
**Method 02:**  
 See Diagram 02.0

////////// Variations

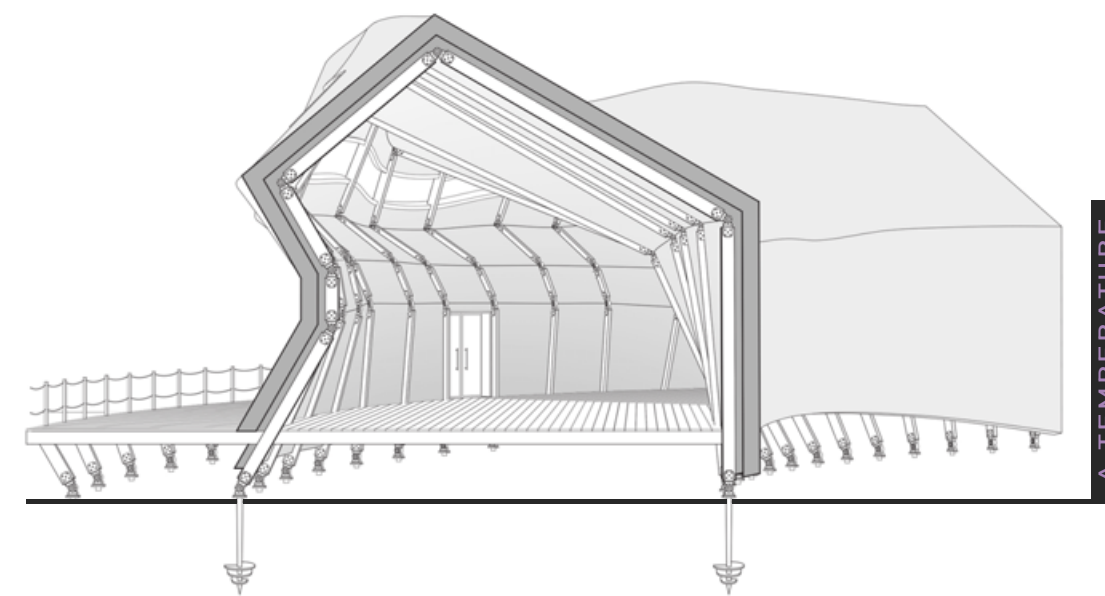
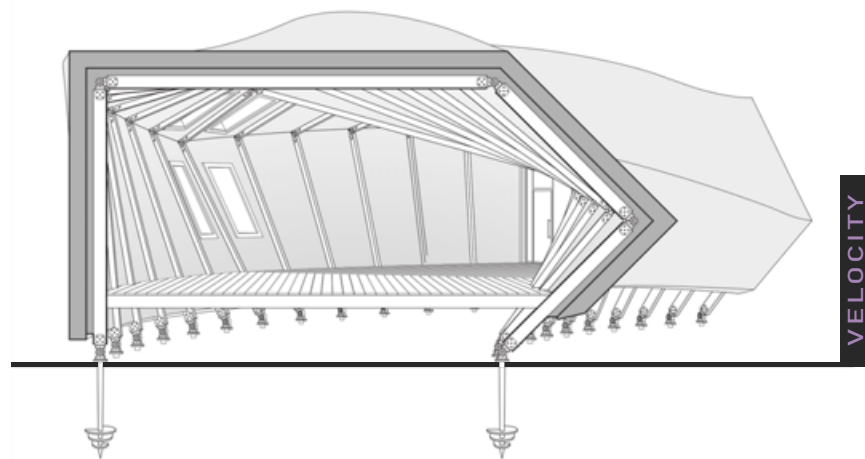
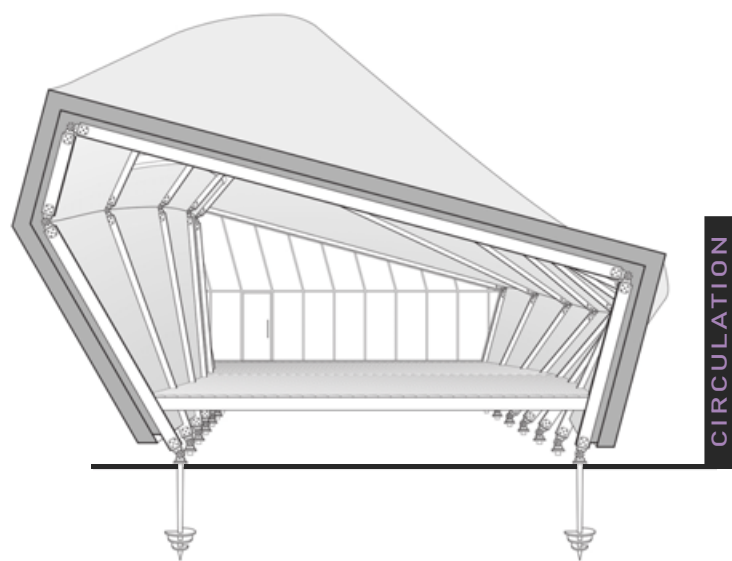
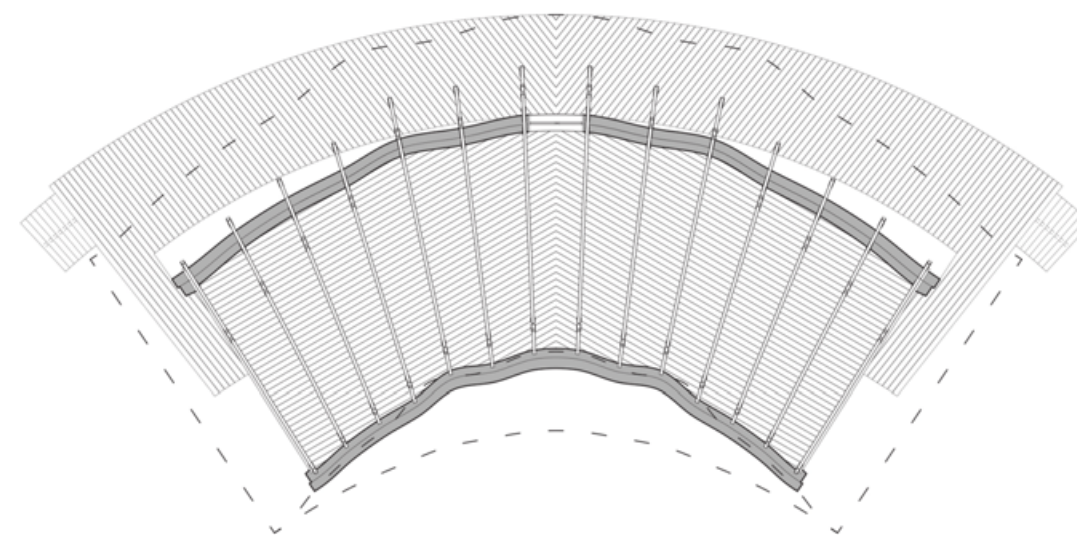
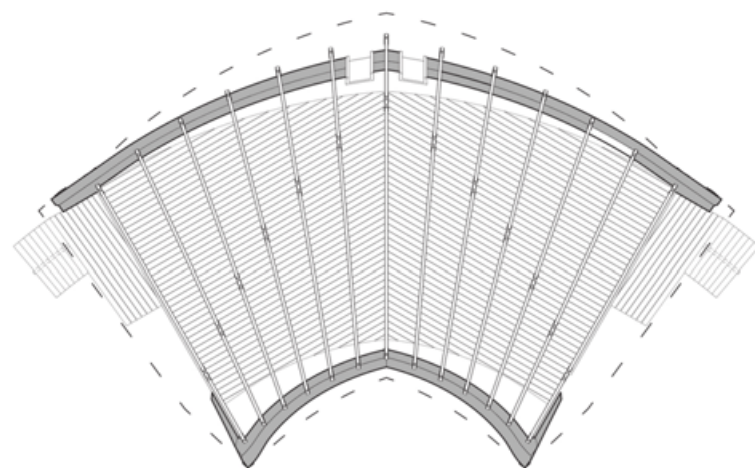
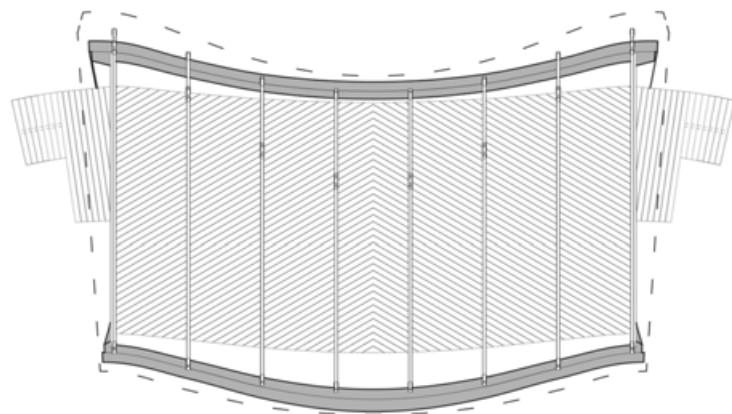
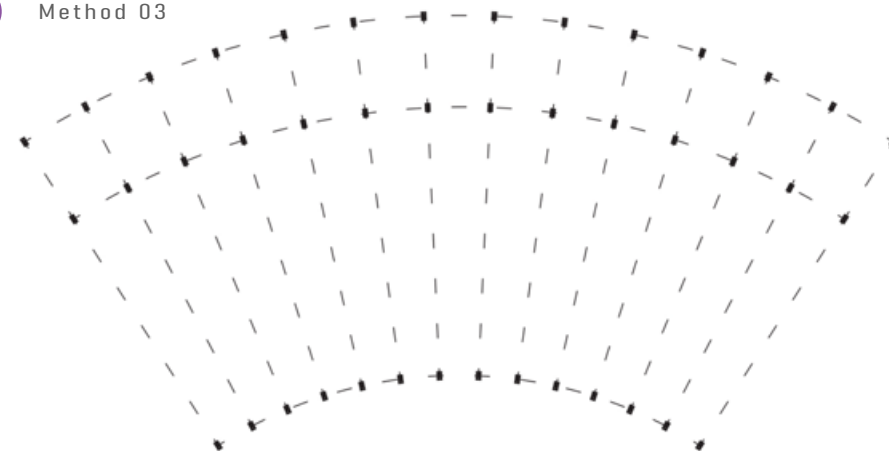
01 Method 01



02 Method 02



03 Method 03



////////// Building Section

EWA 01.0

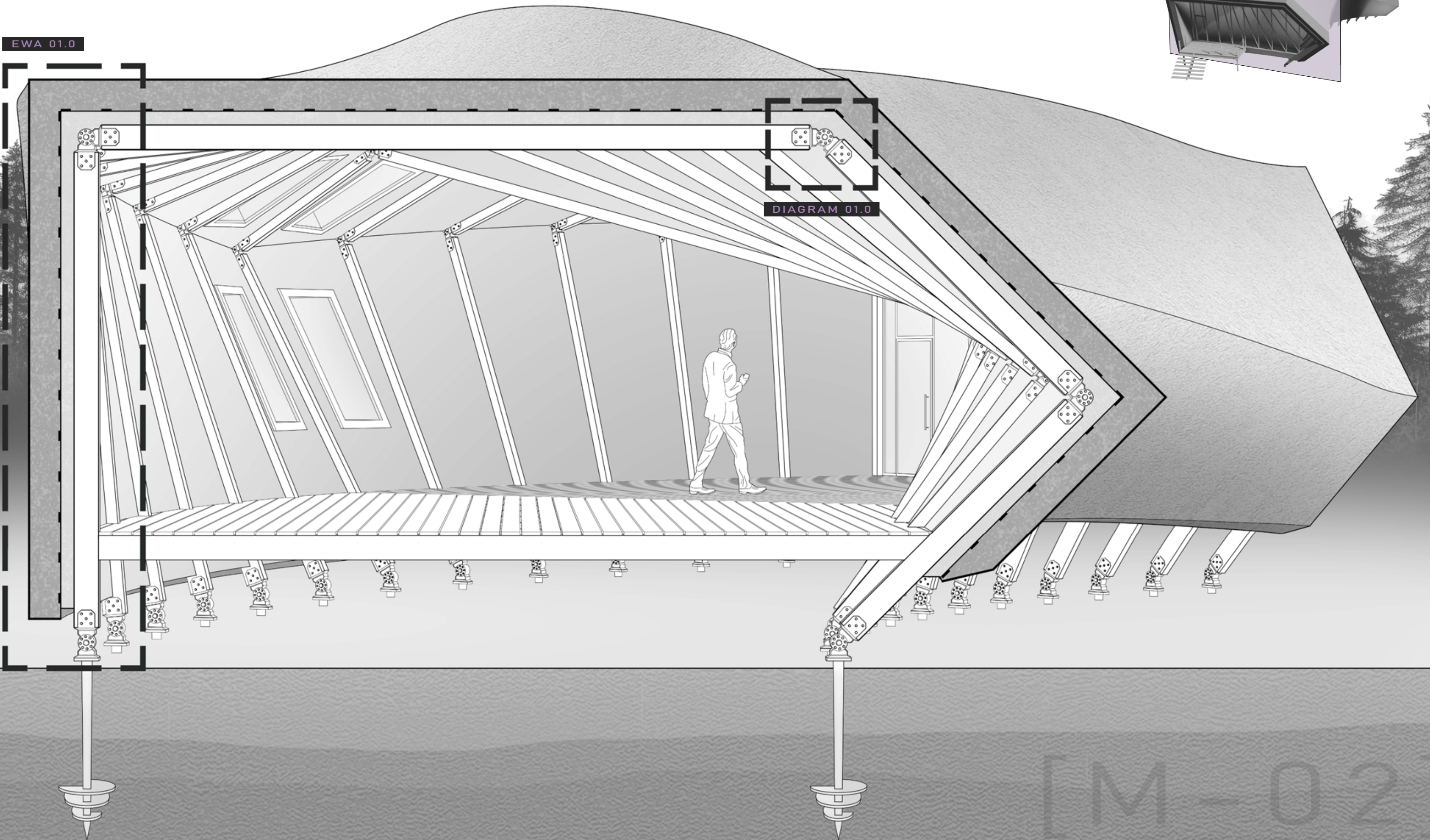
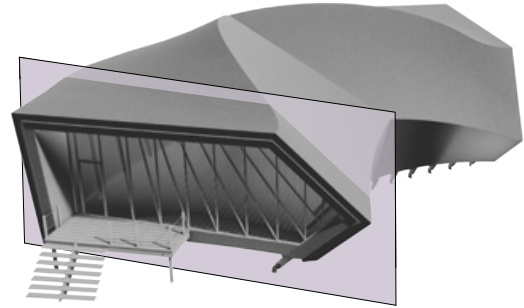


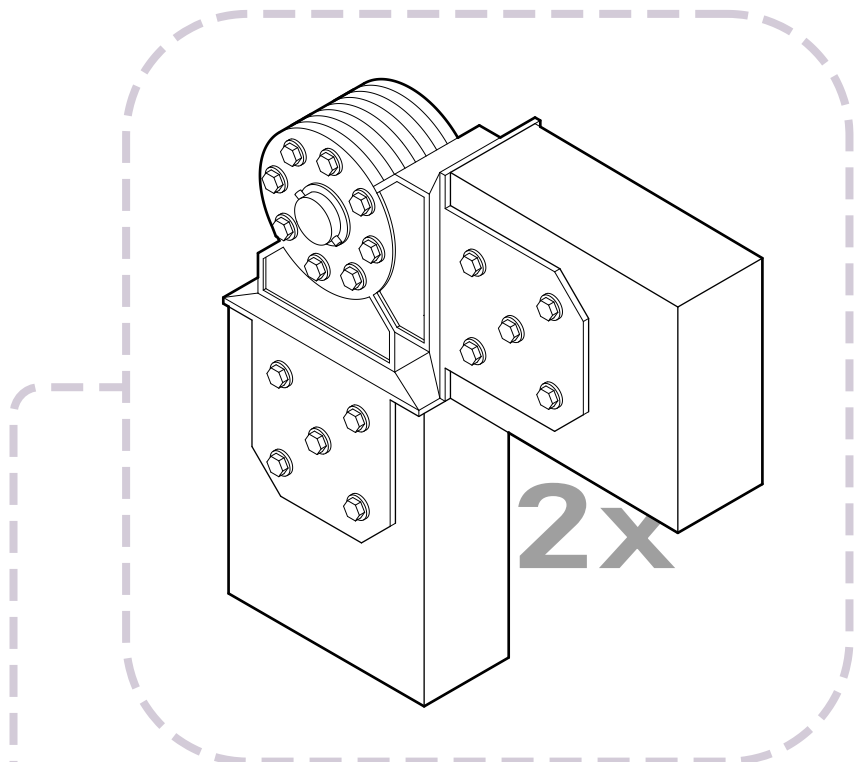
DIAGRAM 01.0

[M-02]

Wall Assembly

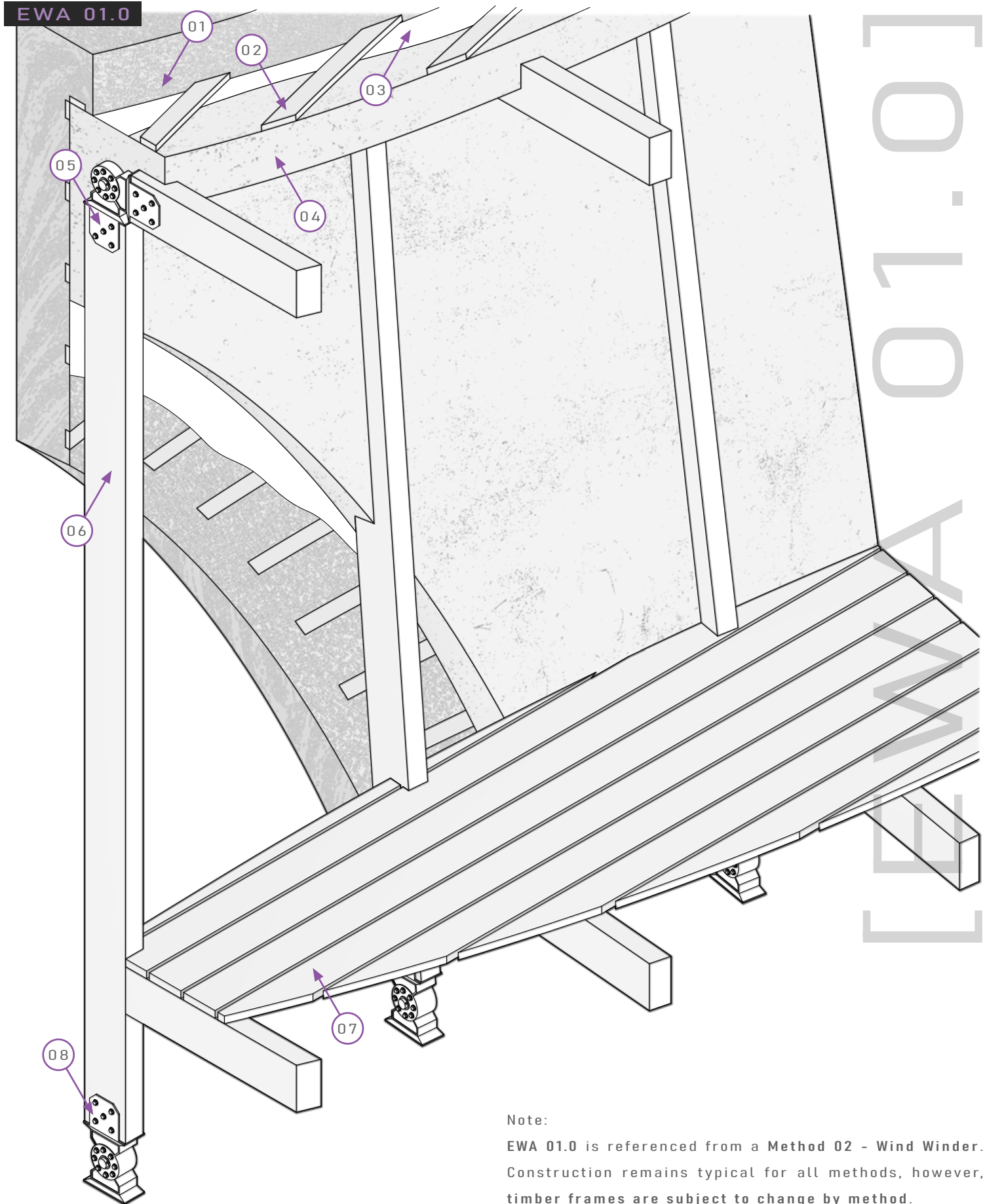
**EWA 01.0 Section:**

The Exterior Wall Assembly (EWA) section shows the 4" x 8" timber frames, capped with the Wind Winders special "Knuckle Locker". The frames are wrapped in 10" of hempcrete starting at the center point of the timber frames moving outwards. The hempcrete offers an R-value of 3.5, along with added strength to the structure. Resulting in a substructure with an approximate total insulating value of R-35. Upon the hempcrete is a non-permeable water membrane placed under the 1x3 nominal strapping, adding lateral support to the frames while serving as a foundation point for the 12" of thatching. The 2" x 6" floor planks with a ¾" spacing between, offers enough strength to span between frames without connecting girders, while also allowing the wind to pass through the floor of the structure.



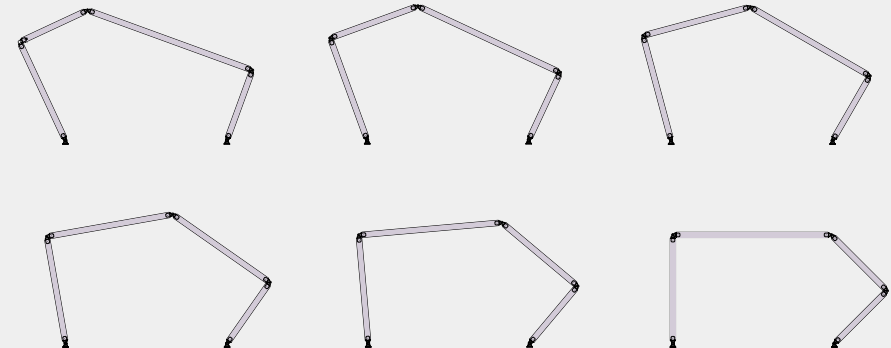
**EWA 01.0 ASSEMBLY**

- 01 Thatching [12" Depth]
- 02 Strapping [1x3 Nominal]
- 03 Waterproof Membrane
- 04 Hempcrete [10" Depth]
- 05 Knuckle Locker [2x Joint]
- 06 4" x 8" Rough Sawn Lumber
- 07 2" x 6" Rough Sawn Lumber
- 08 Knuckle Locker [Baseplate]



**Knuckle Locker:**  
See Diagram 01.0

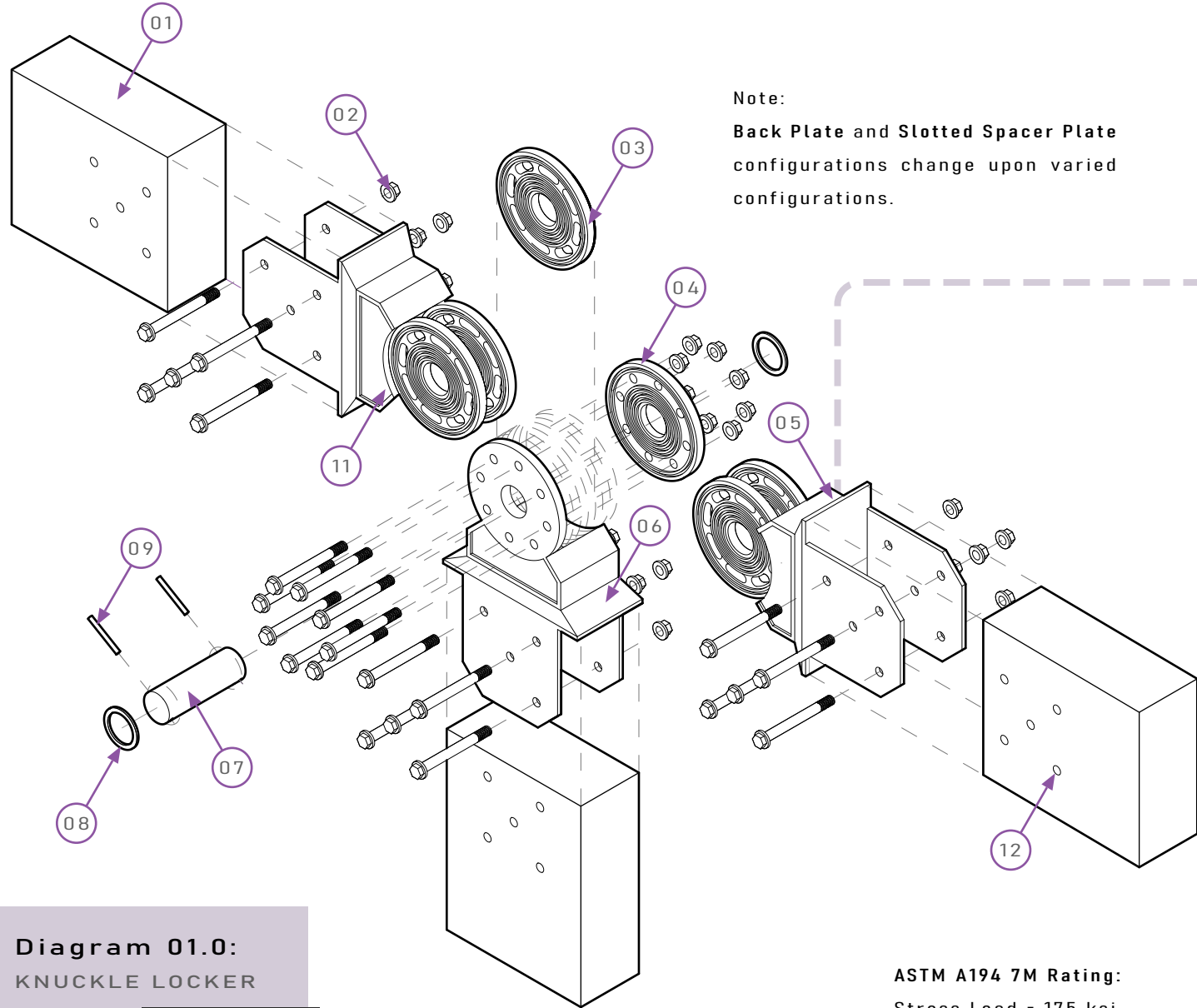
Frame sequences are based on Wind Winder harvesting methods. Shown here is **Method 02**, a variation which relies on **velocity**.



TIMBER FRAMES

Note:  
EWA 01.0 is referenced from a Method 02 - Wind Winder. Construction remains typical for all methods, however, timber frames are subject to change by method.

Knuckle Locker



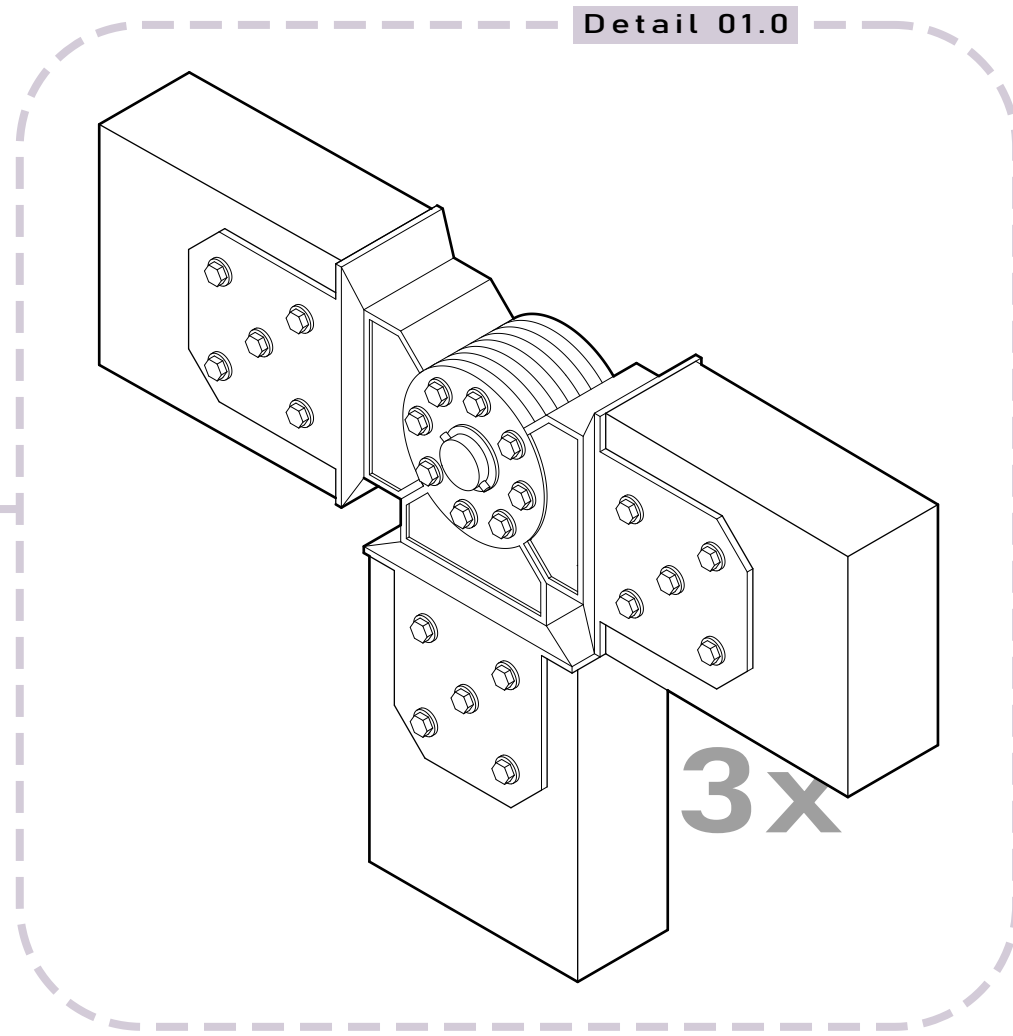
Note:  
Back Plate and Slotted Spacer Plate configurations change upon varied configurations.

ASTM A194 7M Rating:  
Stress Load = 175 ksi

Diagram 01.0:  
KNUCKLE LOCKER  
EXPLODED

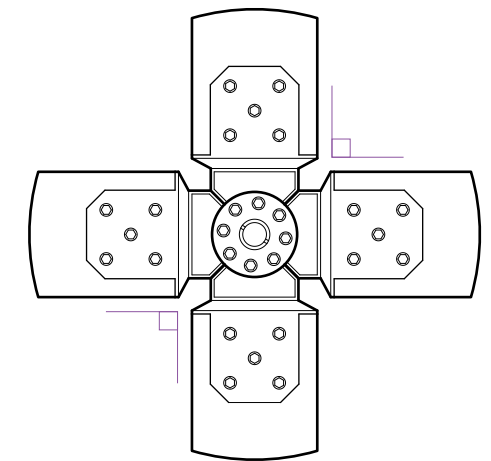
Knuckle Locker:

This custom component allows for a 180° rotation within each junction point of each timber frame. This critical piece of the structure is designed to support up to 4 attachments at 90°, 3 attachments with 120° of motion, or 2 attachments with 180° degrees of motion. Featuring a universal base plate that can be swapped from the 5-hole timber mount to the 4-hole flat-mount. The system works with a 1.5" hardened steel sheer rod at its core with 1/2" friction plates featuring 7 friction rings that press upon each other. Each plate is slotted with 8 holes for 1/2" shaft bolts. The bolts are responsible for compressing the friction plates together, while the slots allow for a full 360° rotation around the sheer rod. For an assembled view see [Detail 01.0](#).

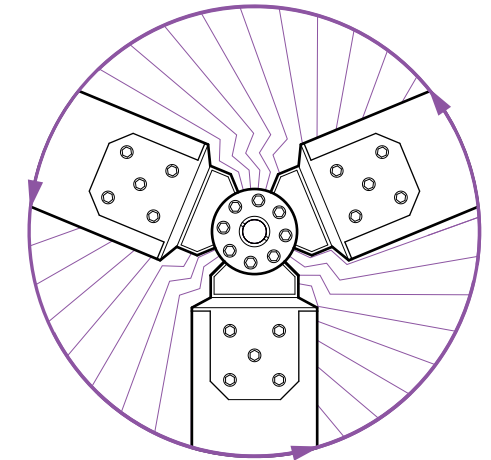


KNUCKLE LOCKER ASSEMBLY

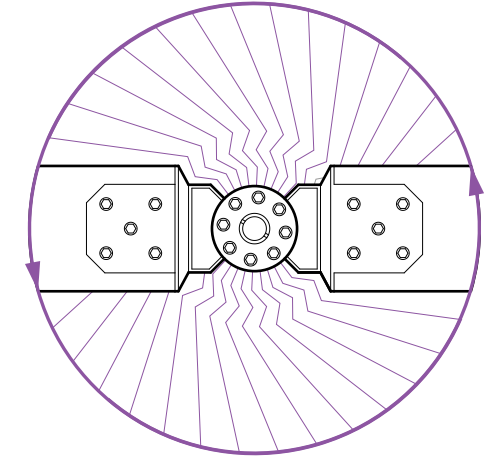
- 01 4x8 Rough Sawn Lumber
- 02 ASTM A194 7M - 1/2" Nut
- 03 Slotted Spacer Plate
- 04 Back Plate
- 05 Housing [C]
- 06 Housing [A]
- 07 Shear Rod
- 08 Shear Rod Washer
- 09 3/8" Shear Rod Pins
- 10 ASTM A194 7M - 1/2" Bolts
- 11 Housing [B]
- 12 1/2" Bore Whole



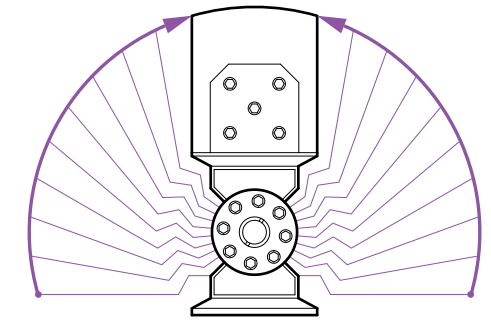
4x Joint



3x Joint

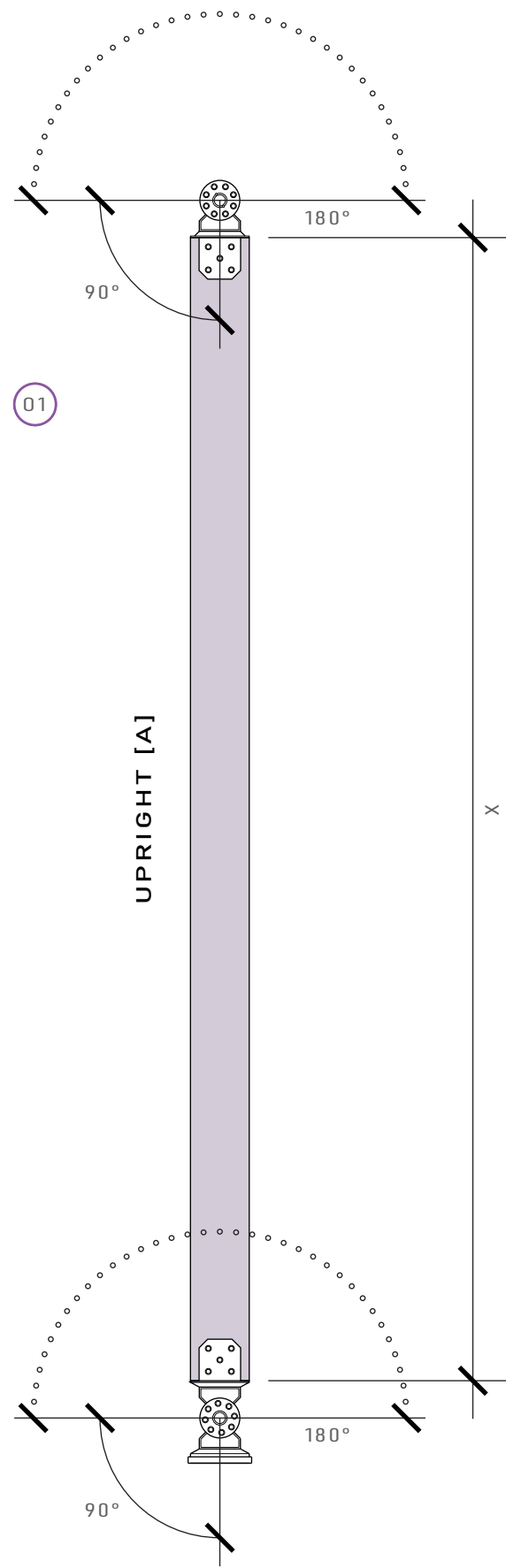


2x Joint



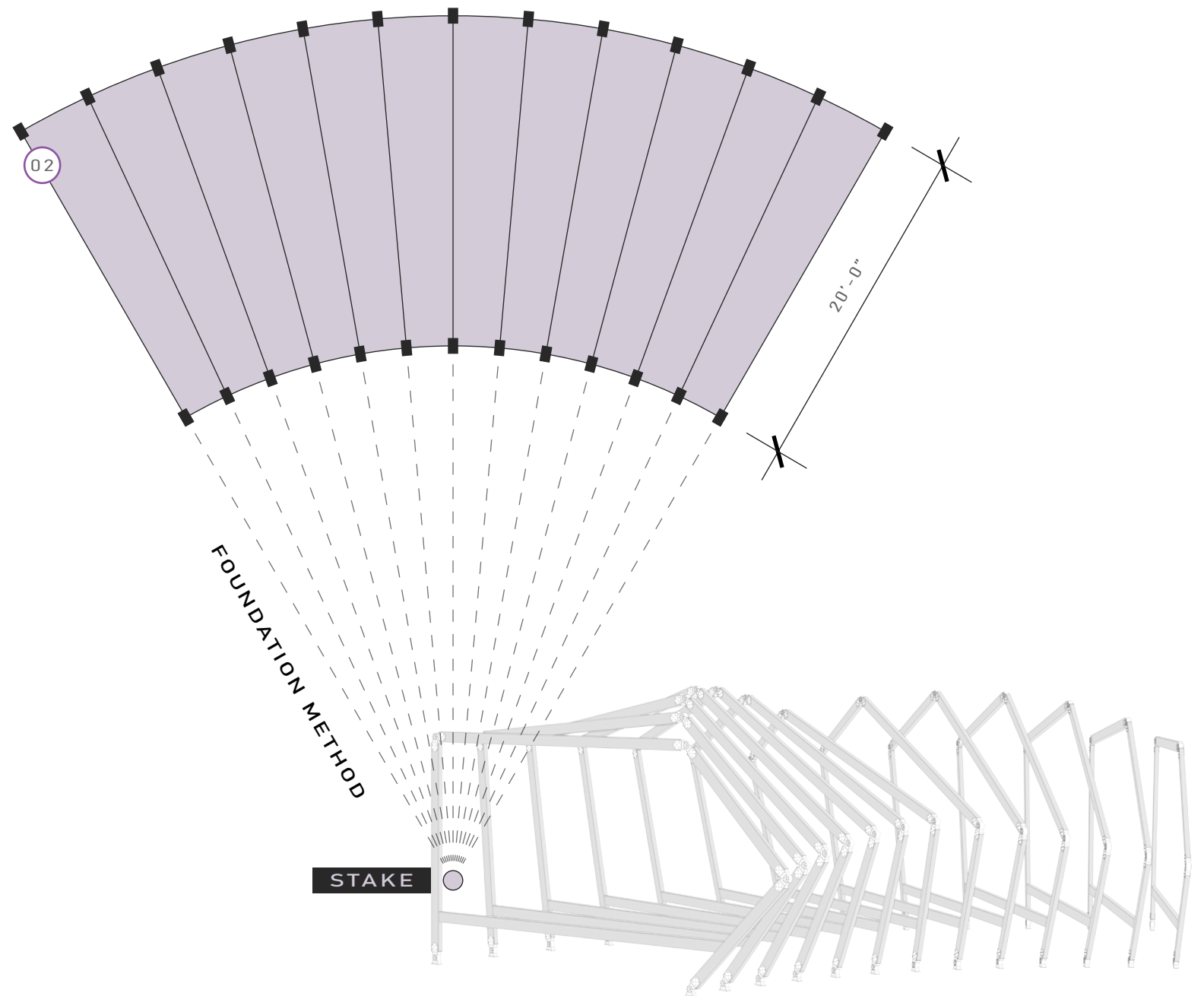
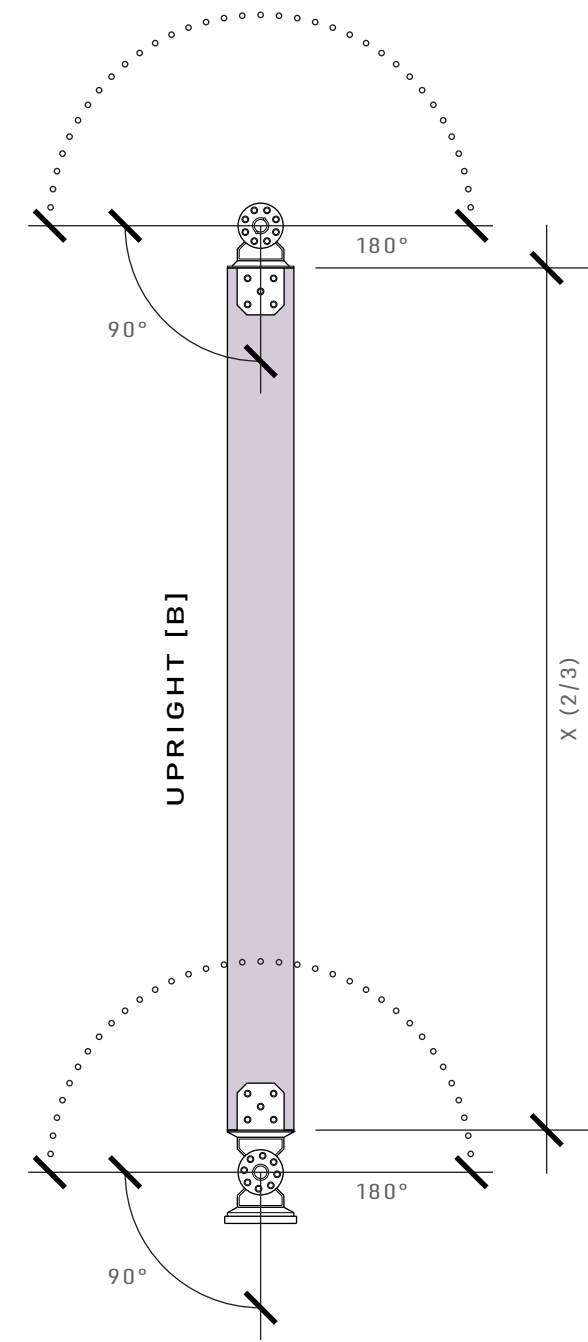
Basemount

Parameters



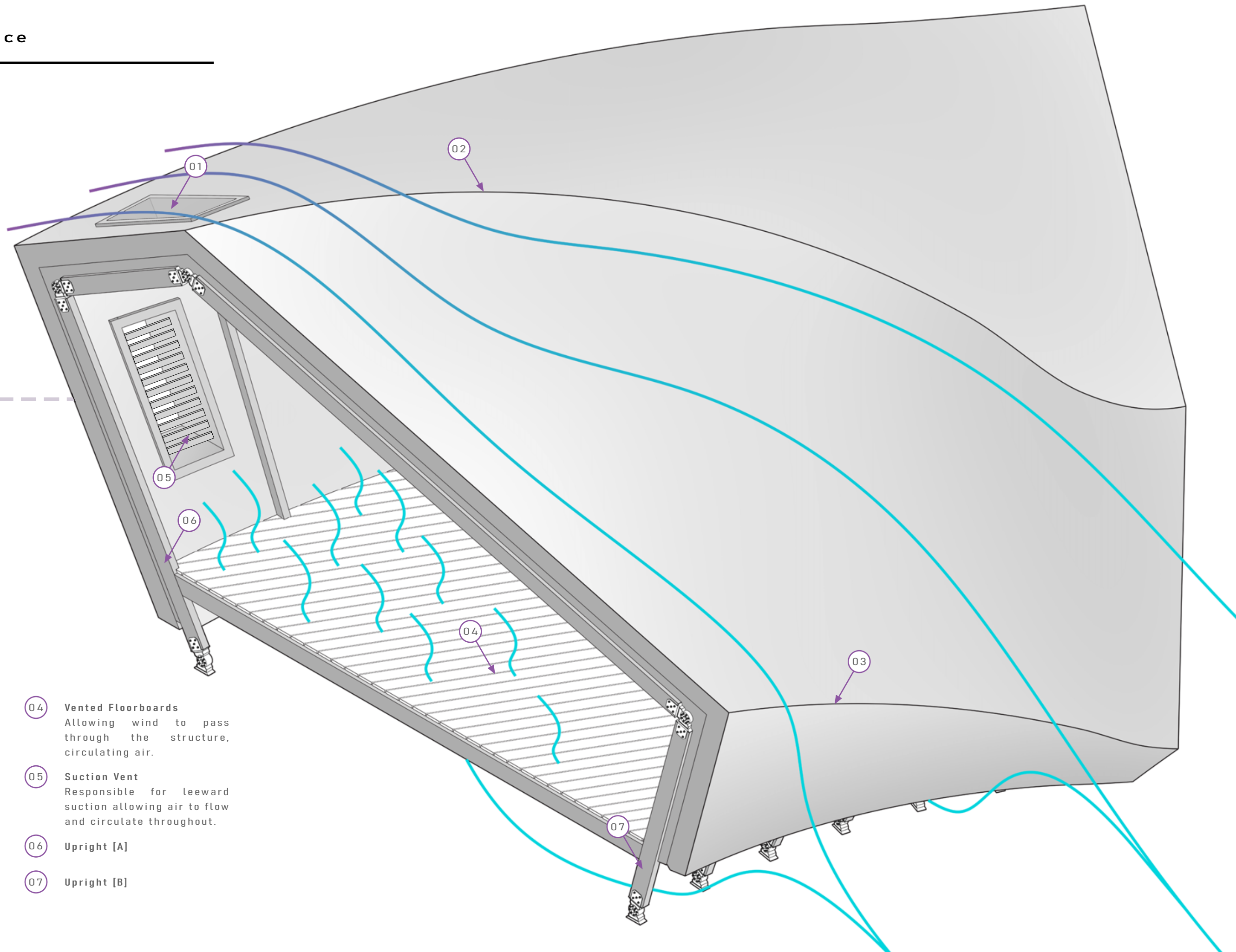
**01 Wall Parameters**  
 Wall A and Wall B are the starting uprights from the foundation ground-screws. The ratios shown are maintained for all variations of cabins.

**02 Foundation Parameters**  
 Shown in plan, all cabin foundation-screws are mapped by following this technique. Allowing for a simple erection and maintained for all cabin variations.



**Construction:**  
 Keeping a simple construction in mind, each variation of the Wind Winder maintains the exact ratio along its upright lengths. Wall [A] being X, and Wall [B] being [X (2/3)]. Allowing for a simple erection at the start of construction, while still being dynamic and versatile for wind harnessing. Also Demonstrated is the Knuckle Locker's ability of motion, both with the 5-hole timber mount and the 4-hole flat-mount at grade.

Maintaining a simple construction, all Wind Winder Cabin foundations can easily be mapped by marking a stake in the ground and drawing a tensioned line from it, followed by some simple calculations.



**Diagram 02.0:**  
METHOD 02

#### FUNCTIONS

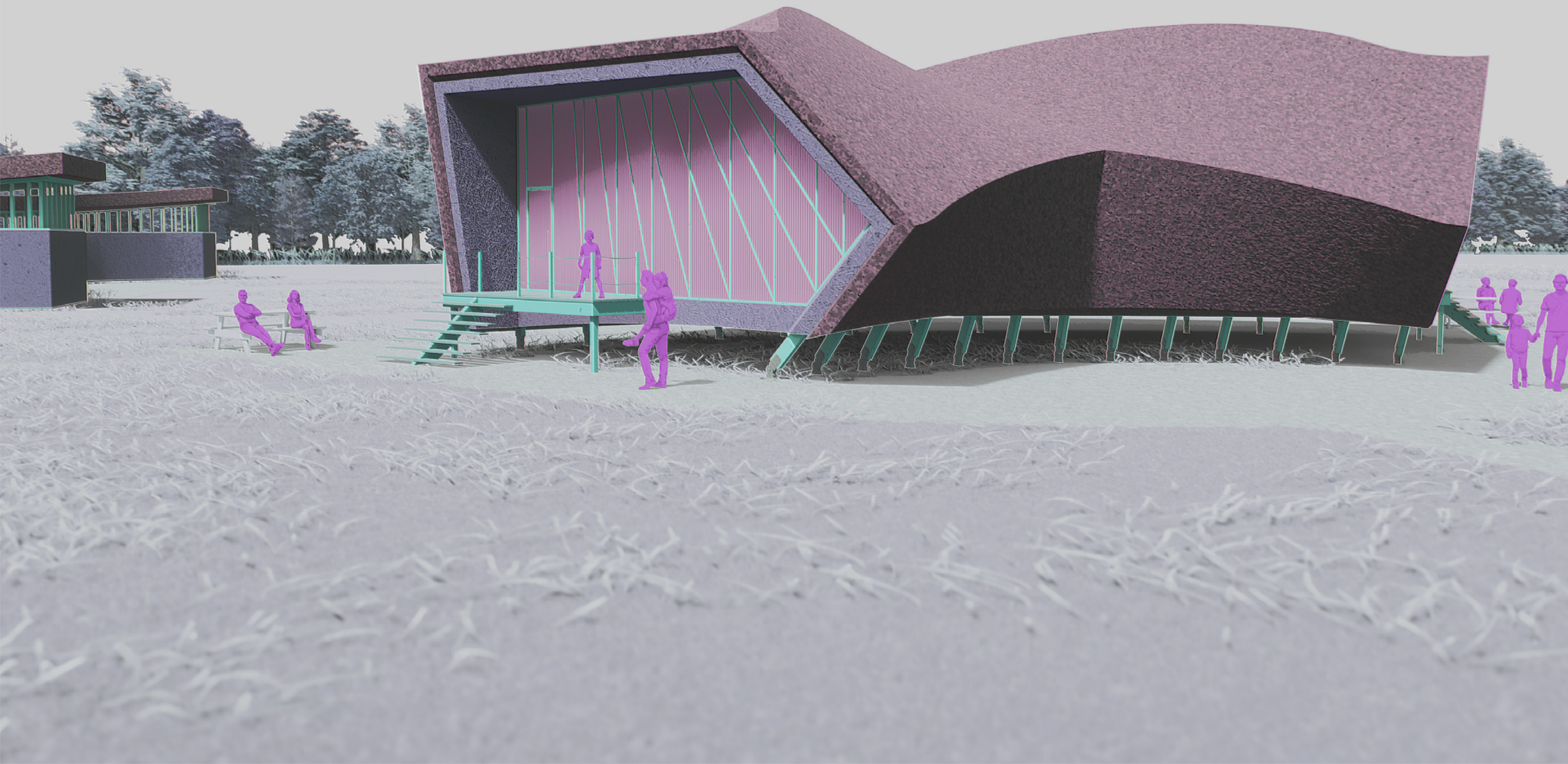
- 01 **Skylight**  
Illuminating the center space of the wind winder cabin.
- 02 **Ridge Wind Guide**  
Guiding the incoming wind towards the leeward suction vents.
- 03 **Wind Splitter**  
Splitting incoming wind into two paths creating positive and negative pressure.
- 04 **Vented Floorboards**  
Allowing wind to pass through the structure, circulating air.
- 05 **Suction Vent**  
Responsible for leeward suction allowing air to flow and circulate throughout.
- 06 **Upright [A]**
- 07 **Upright [B]**

Seed Library - Method 03  
Boomerang Gardens



Cabin - Method 02

Boomerang Gardens



Blueberry Harvest - Remediation Zone  
Boomerang Gardens

