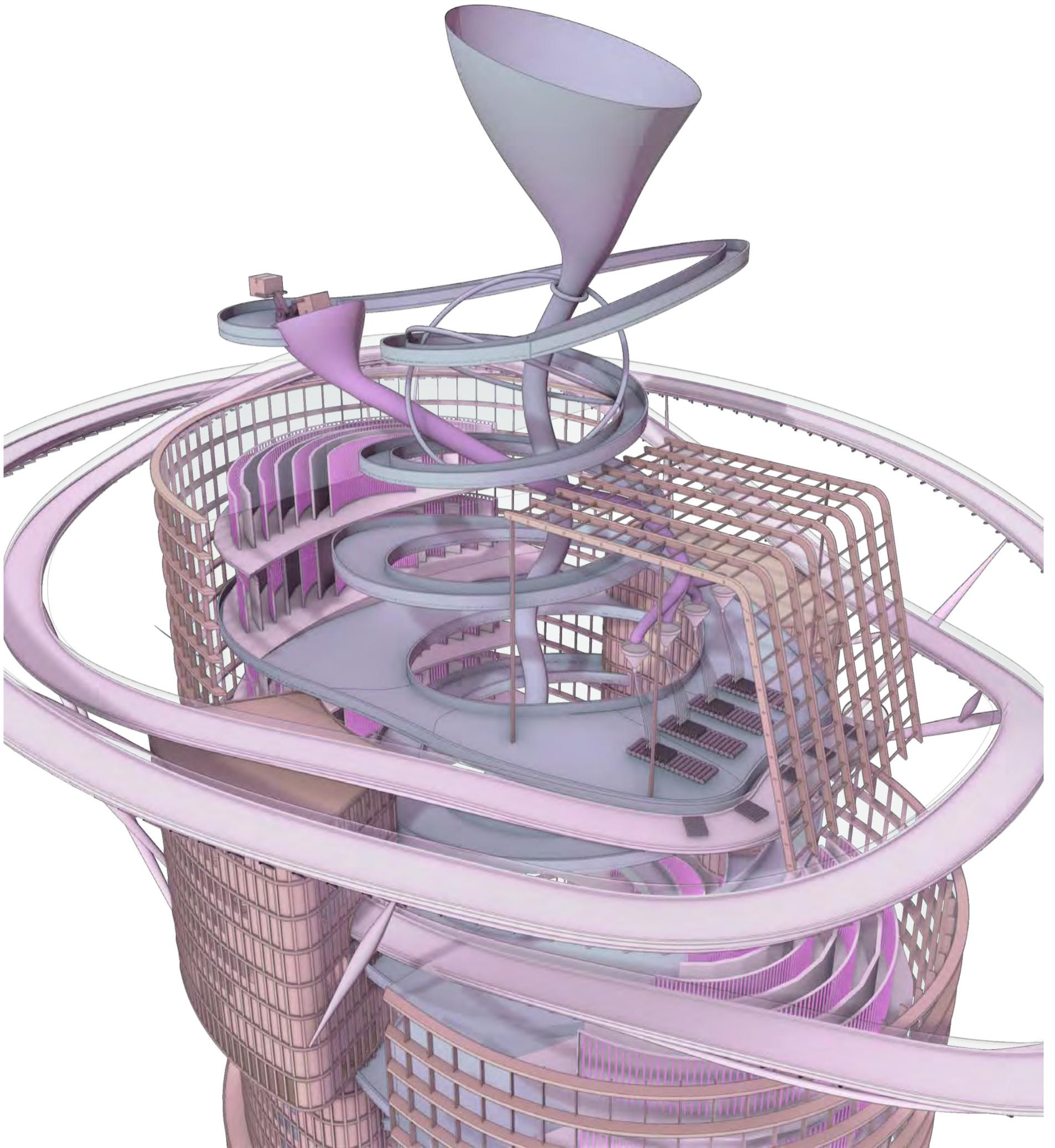


SOYSCAPE

VERTICAL FARM



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Kerry Dickinson

SOYSCAPE

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RESEARCH

THE

WORLD IS

PANICKING

- AS IT

SHOULD

BE.

RESEARCH

MANIFESTO

THE PROBLEM

The world is panicking – as it should be – about the future of our planet. The population is continuously increasing and the demand for space and resources will continue to increase too. Cities are becoming denser and reserve the best quality spaces for those in positions of wealth. This negatively impacts other residents through a lack of access to green spaces and cramped, low quality dwellings.

Designers need to be smarter and more creative in their work. The technology and information that exists in the present is beyond sufficient to rectify the abundance of issues that are rapidly accumulating due to society's current behaviour. People choose to continue life, pretending that the solutions to our problems aren't within reach today and this needs to change.

DEMANDS

Our reliance on nature needs to be acknowledged further than food consumption alone. Garden spaces are to be considered equally essential to a home as a bathroom or kitchen. The journey between realms should always provide contact with plants and nature. Travelling between the apartments and floors of a high rise building should be accompanied by the presence of greenery. This presence is usually limited to public parks for many city residents.

Furthermore, there should be no limit to the purpose of this greenery. This can and should include aesthetics and food produce, both contributing to general well-being.

Such purposes demand vertical farms that have the ability to sustain the lives of those living within the city.

An improved connection to nature requires that we begin to respect its worth more than we currently do.

Our impact on the environment needs to be drastically reduced and, to aid this, renewable energy technology needs to be utilised further. Power of the sun, air and even water should be captured wherever possible to supply beyond current energy demands.

To tackle the issues surrounding small and poor quality housing, smarter designs need to be implemented alongside regulations that make some of the current housing standards unacceptable. Maintenance of buildings should be factored into the budget more rigorously to avoid the standards falling simply due to a lack of funding.

WHO

Many architects and designers have the power to work towards implementing these changes, but choose not to. There is a fear of the unknown meaning new ideas and technologies are less likely to be chosen by clients that want to minimise any financial risks. Our regulations and laws surrounding nature and sustainability don't change quickly enough to reflect what is possible. There are many groups and challenges that demand for better architectural designs, but these are not enforceable by law and are only pleas from those that are more aware of the current issues.

RESEARCH

INTERSTELLAR



The 2014 film *Interstellar* gives an insight to what the future of agriculture farming could look like in terms of both environmental issues and automation. The tractors, harvesters and other machinery all operate using AI and GPS technology enabling the food production to take place with minimal human interference.

To maximise food production in the future, automation is going to be vital and will be extremely appropriate for high tech farms exploring alternative ways to grow food. With the population of London set to reach 9.5 million people in 2026, this technology has the potential to ensure that each person has access to the food they need.

RESEARCH

CHARLIE AND THE CHOCOLATE FACTORY



Charlie and the Chocolate factory explores the concept of allowing people the unusual experience of witnessing the processes their food goes through before being placed on a shelf to be purchased. The whole experience for each of the five children and their guardians in the film is both eye opening and shocking due to the unusual methods of the Willy Wonka chocolate factory that have remained hidden away from the consumer throughout its existence.

The film, although unrealistic in many aspects, resembles the reality of food production in 2021. Much of the public are unaware of the processes that come before food arrives at the supermarket or restaurant whilst only a small percentage of people have ever visited a farm.

Could a farm be placed in the city to allow the public to reconnect with their food in ways that are both exciting and educational?

RESEARCH

FOOD IMPORTS

**80% OF
THE UK'S
FOOD IS
IMPORTED.**

<https://www.businessinsider.com/no-deal-brexite-percentage-british-food-imported-shortages-2019-1?r=US&IR=T#:~:text=Say%20goodbye%20to%20tea%20and,deal%20Brexit%2C%20HSBC%20tells%20clients&text=Most%20people%20think%20Britain%20only,such%20as%20carrots%20and%20tea.>

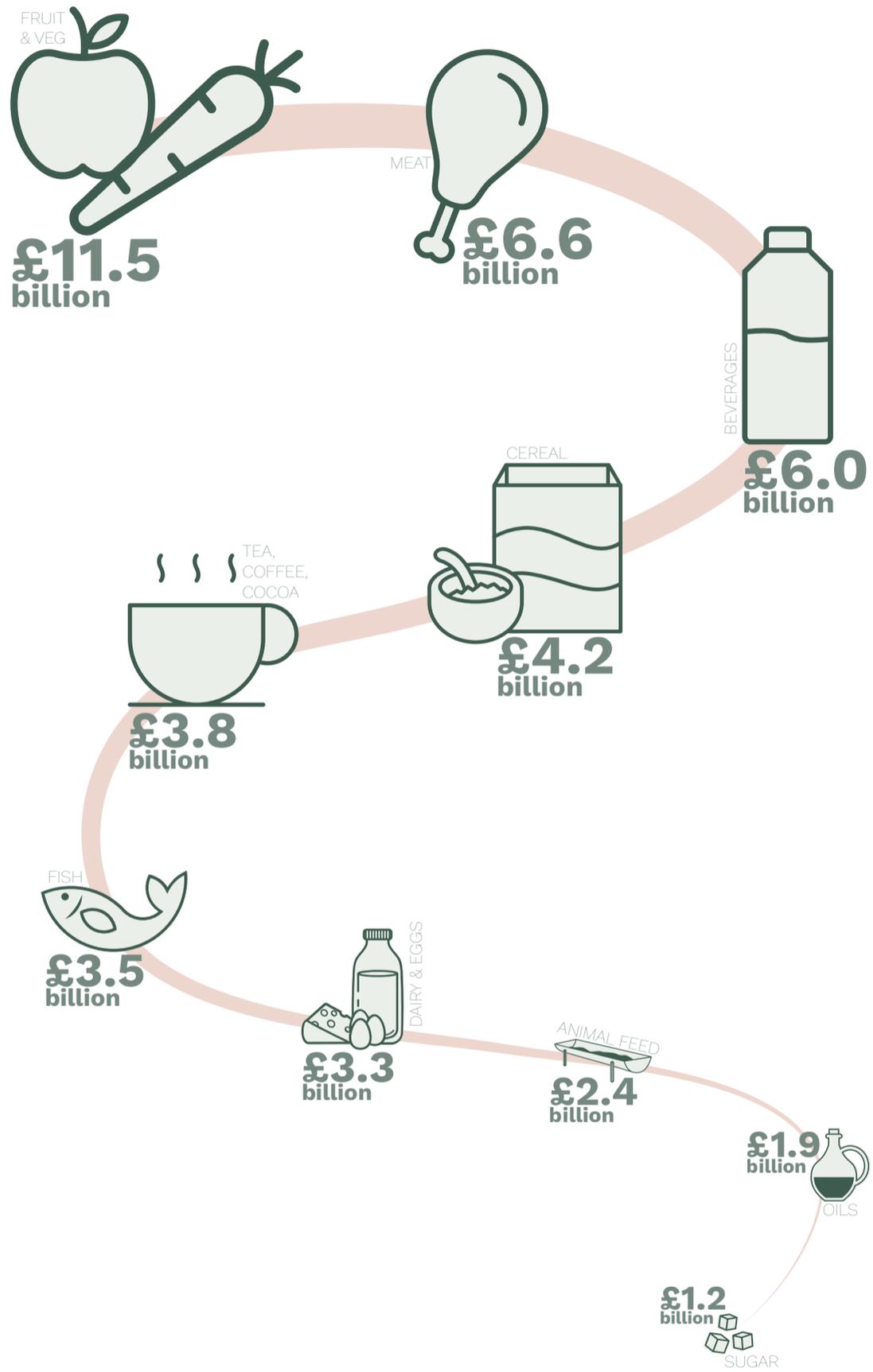
RESEARCH

FOOD IMPORTS TO THE UK IN 2019

OVER A QUARTER OF GLOBAL EMISSIONS COME FROM FOOD

FOOD
26%

OTHER GREENHOUSE GASES
74%

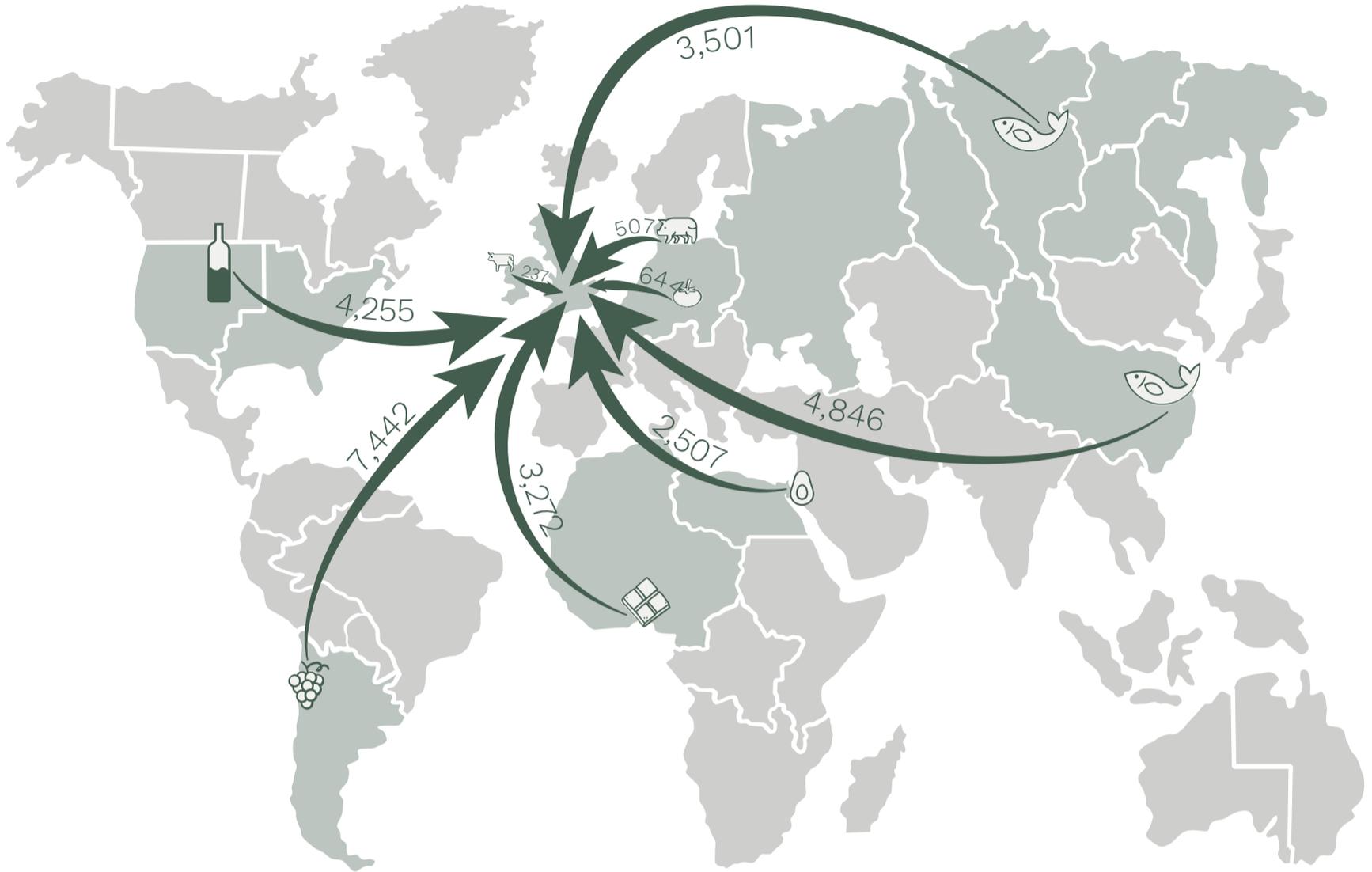


Poore & Nemecek (2018). Science

Data taken from:
<https://www.gov.uk/government/statistics/food-statistics-pocketbook/food-statistics-in-your-pocket-global-and-uk-supply#:~:text=Based%20on%20the%20farm%2Dgate,food%20consumed%20in%20the%20UK>

RESEARCH

FOOD MILES NEED TO BE REDUCED



Inspiration taken from: <https://www.dailymail.co.uk/news/article-8116925/Downing-Street-urges-people-not-panic-buy-insists-supplies-imported.html>



This map shows the locations of two food factories in the UK that supply to London.

Even after our food has travelled across the globe to get to the UK, it is then processed and packaged and put on yet another mode of transport to reach shops, cafés and restaurants before being put on our plates.

WHAT IF THIS JOURNEY CULMINATING IN THOUSANDS OF FOOD MILES COULD BE REDUCED TO JUST A FEW HUNDRED METERS?

RESEARCH

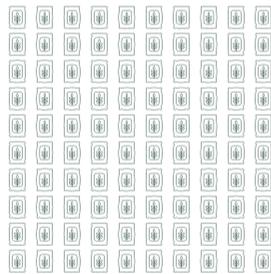
NO FIELDS, NO PROBLEM



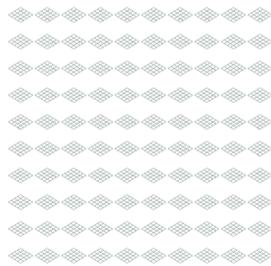
Sky Greens Vertical Farm:
<https://inhabitat.com/sky-greens-is-the-worlds-first-hydraulic-driven-vertical-farm/>

CONVENTIONAL LAND-BASED FARMING

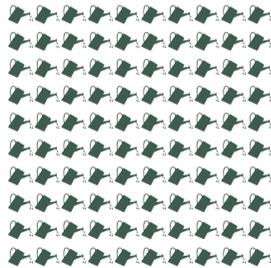
FERTILISER



SPACE



WATER



VERTICAL FARMING



Moving the farming and food production into the city enables the reduction of food miles and carbon emissions.

However, growing food in London poses some issues such as:

1. Incorrect climate to provide a continuous food source throughout the year.
2. Lack of spaces for fields, greenhouses and polytunnels.

Vertical farming solves these issues by providing a closed and controlled environment suitable for growing a desired crop and uses less pesticides, fertiliser, space and water compared to conventional land-based farming.



RESEARCH

AUTOMATION



Automation in agriculture is already present in conventional land-based farming.
<https://fortune.com/2020/10/05/a-i-precision-agriculture-deere/>



AI and automation enable the majority of farming processes in vertical farm companies such as Bowery and Iron Ox. This automation can be seen carrying out the necessary tasks from the seeding process at the beginning all the way through to deciding when the food is ready to harvest.



The ability to plant seeds, transport the growing produce around the farm and get it packaged up entirely through automation and AI will be used in SoyScape using conveyor belts, robotics and other technology.

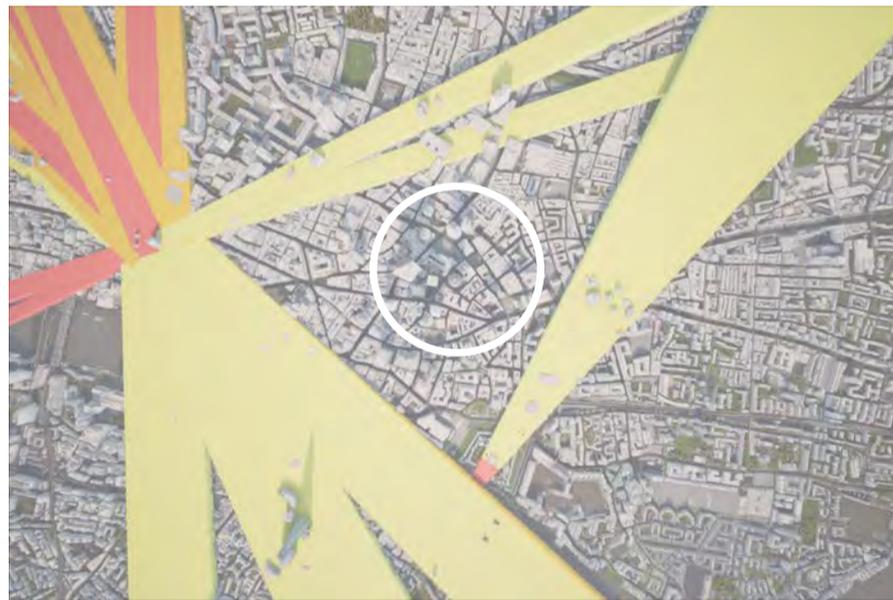
SITE

SITE

THE CITY OF LONDON



This shows how the City of London will look in the early 2030s based on designs that have begun construction or been approved.



The eastern cluster within the city of London allows for high rise development due to not interfering with the protected views in London shown above.

There has always been a significant demand for office space in the area in order to maintain London's standing as a global financial centre. However, it could be argued that, due to the change in working habits since the start of the Covid-19 pandemic, the demand may not be as high.

Due to the current program of the area being mostly office buildings along with some cafés, restaurants and bars that close outside of office hours, the surrounding streets become void of any human life throughout the weekend.

Placing a space that encourages people to travel to the area during these quieter hours would make use of the City of London space, potentially reducing the amount of people visiting the more crowded areas.. Utilising the empty areas of London at weekends is likely to become more vital as the city's population continues to increase.

SITE

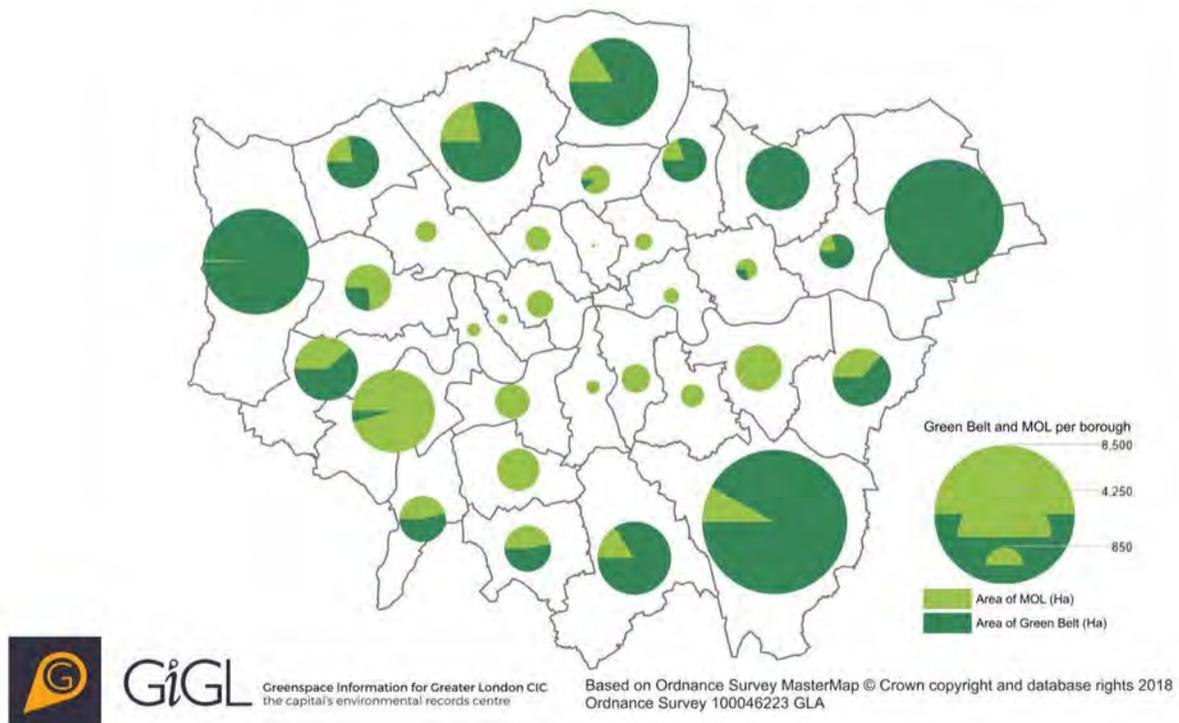
THE CITY OF LONDON



This Greenspace Information for Greater London map shows all the green spaces, both public and private, across the city.

Area of Green Belt and MOL per borough

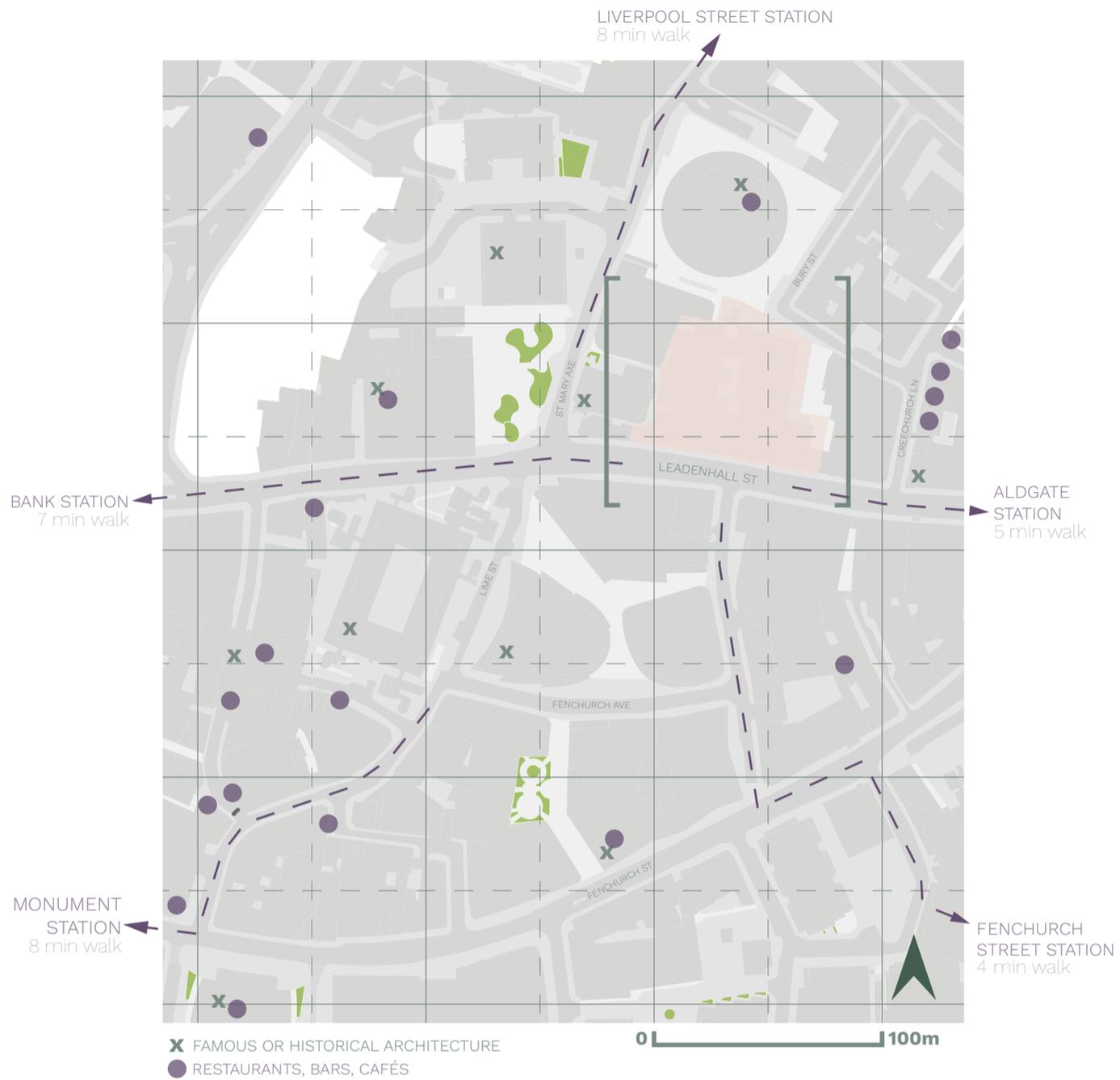
Produced by Greenspace Information for Greater London CIC on behalf of CPRE London, July 2018



The City of London has no Metropolitan Open Land within the City of London boundary.

SITE

100 LEADENHALL STREET



The site chosen for this project is 100 Leadenhall Street on which the buildings below currently sit. These buildings are generally mixed retail or work spaces which can be accommodated into the

new building. The site sits just south of 30 St Mary Axe and close to other famous or historical architecture such as St Andrew Undershaft church and Lloyd's of London.

BUILDINGS CURRENTLY ON SITE



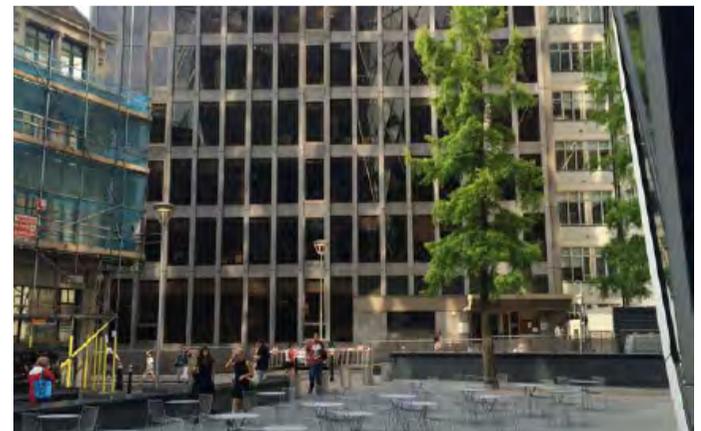
107 Leadenhall St.



106 Leadenhall St.



100 Leadenhall St. (front)



100 Leadenhall St. (back)

SITE

PUBLIC ACCESS TO NATURE



Assessing the number of areas designed for the enjoyment of nature within a 10 minutes walk of the site demonstrates the lack of such spaces in the City of London.

----- 5 min walk

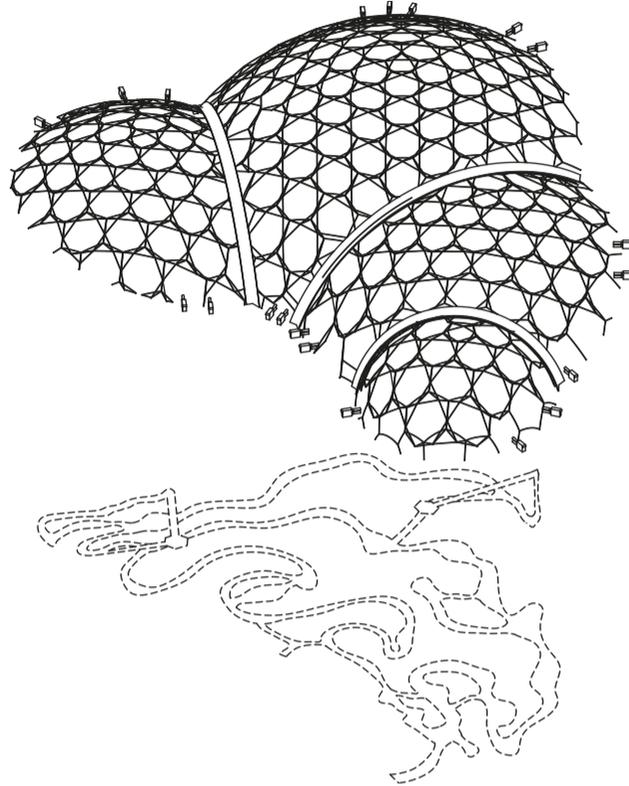
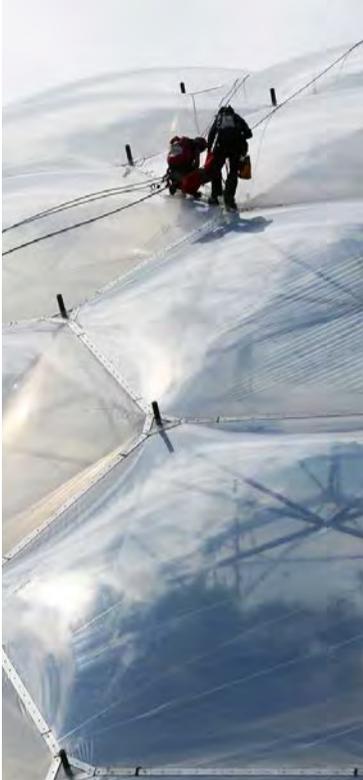
----- 10 min walk

PRECEDENTS

PRECEDENTS

GROW SPACES

THE EDEN PROJECT, UK



The Eden Project is a not for profit charitable trust situated in Cornwall, UK that aims to highlight the important connection between people and plants. It looks towards promoting the understanding of resources leading to a more sustainable future and had an initial goal to build the first greenhouse in the world that could contain an entire rainforest.

The structure is clad using ETFE (Ethyltetrafluorethylene) foil which enables maximum ultraviolet light to reach the plants and is so light that each panel can be lifted by one person.

The ETFE foil creates air filled cushions made up of three layers which allow for further climate control. Rain water is able to run freely down each cushion due to the smooth surface and is saved to water the plants inside the biomes. The Eden Project shows that plants from other parts of the world can thrive in the UK with the right technology.

PLENTY, SOUTH SAN FRANCISCO



This particular farm called Tigris is the most automated farm owned by Plenty. It grows using LED lights all year round and can grow 1 million plants at once with the ability to process 200 plants per minute.

The robots in the vertical farm have the ability to plant the seeds into the long growing tubes and then stand them up vertically so they can join the walls of growing leafy greens.



PRECEDENTS

GROW SPACES

AEROFARMS, NEW JERSEY



Aerofarms grows their leafy greens in an arrangement of stacked shelves, similar to Bowery (pg 13), but with less automation. The farm uses proprietary aeroponics which allows growing to be optimised, producing food that can be sold and eaten locally.

Their method of growing allows them to avoid using pesticides, herbicides and fungicides which means all of the produce can be eaten out of the package without washing first.



TOFU FACTORY by DnA, CHINA



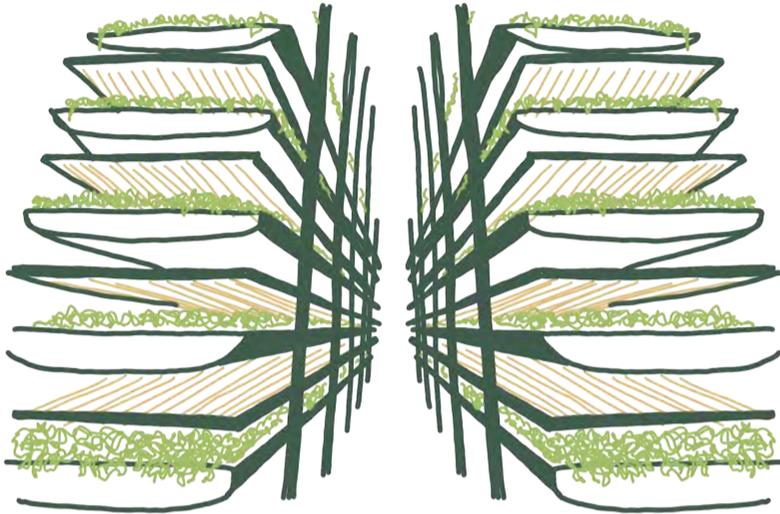
This tofu factory is situated in the village of Caizhai in Songyang, China. The production system is not high tech but the materials and immense amount of light create a space that successfully connects the workers with their natural surroundings.

Being able to connect the farming and processing spaces with the exterior spaces will be a major aspect in the SoyScape project.

PRECEDENTS

GROWING STRATEGIES

STACKED GROWING TRAYS



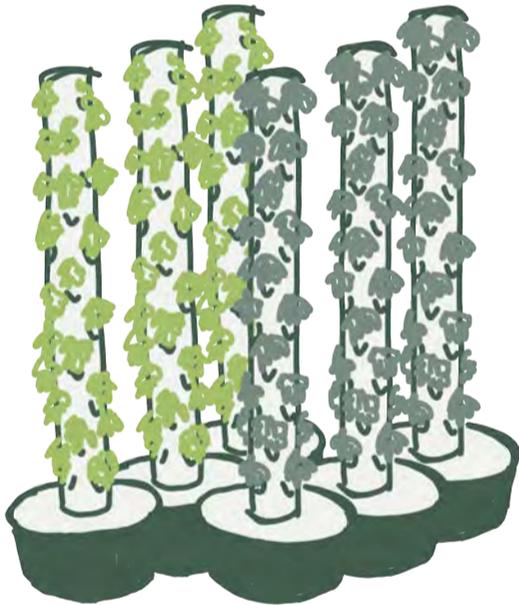
Used by farms such as AeroFarms and an automated version by Bowery. Can be stacked extremely high. Piping and trays allow nutrients and water to run underneath each level.

ROTATING SHELVES



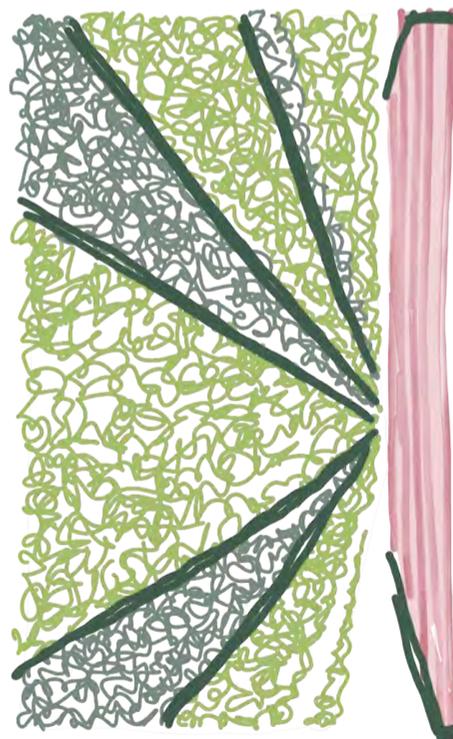
Designed by Singapore vertical farm Sky-High, these shelving units rotate to allow natural light to reach the growing greens on every level throughout the day.

TOWER GARDENS



Allow water to be filtered down through each level on the inside of the tower with any extra water and nutrients collected at the bottom of the tower ready to be pumped back up.

GROW WALLS & VERTICAL LIGHTS



Used by farms owned by Plenty and Agricoal. Can be automated and made to fit any room shape due to running vertically instead of horizontally.

PRECEDENTS

GROWING STRATEGIES



Agricool grows strawberries, coriander and other greens in shipping containers located in Paris and Dubai supplying locally grown produce. The LED lighting and growing method fits the width of the container and the lights run vertically between the walls of food growing.

This layout and the wall of LEDs will be adapted and included in the growing spaces of SoyScape.

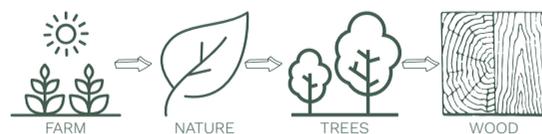
PRECEDENTS

MATERIALS & FAÇADE



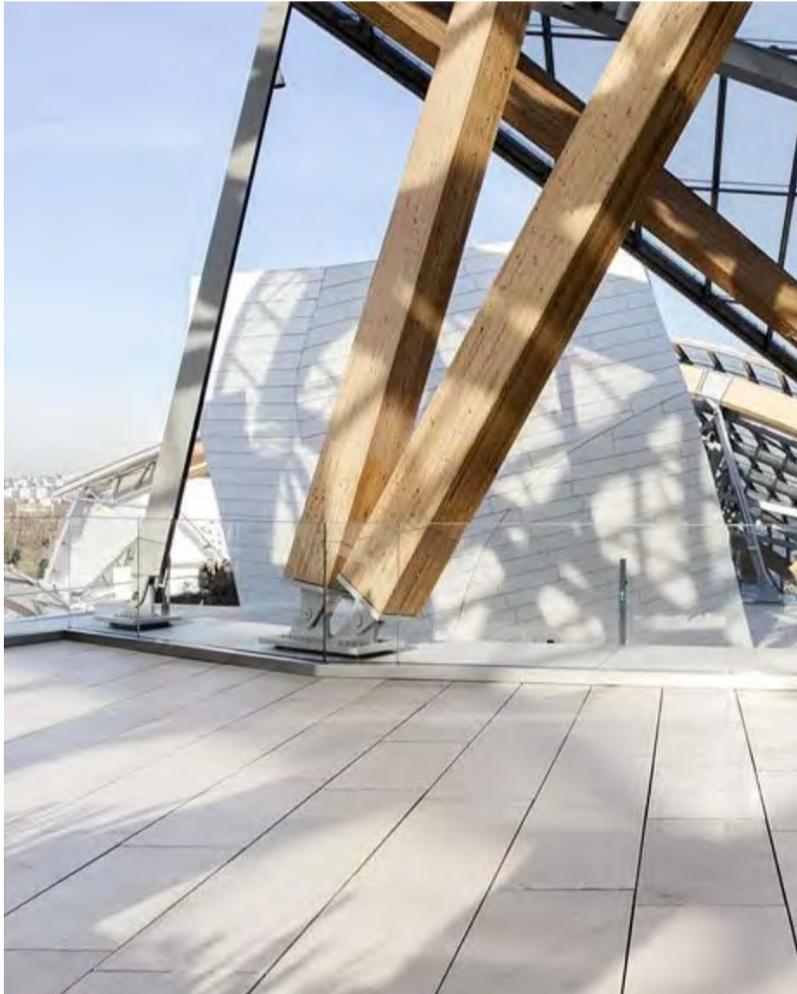
The Vancouver Art Gallery, by Herzog & de Meuron, was initially designed to look like it was constructed out of wooden boxes with variations in the façade allowing varying amounts of light on each floor.

The wood links back to the natural elements such as the farm and green spaces whilst the differing amounts of windows will help to reflect the use of each space on the inside i.e. grow spaces sit within the façades made up of mostly windows.



PRECEDENTS

STRUCTURE



The Louis Vuitton Foundation, by Frank Gehry, has a structure consisting of both steel and glulam timber elements. These parts provide structural support for the sails that create an exterior enclosure.

Similar structural elements will be used to support parts of SoyScape such as the germination and growing spaces of the vertical farm.

PROPOSAL

PROPOSAL

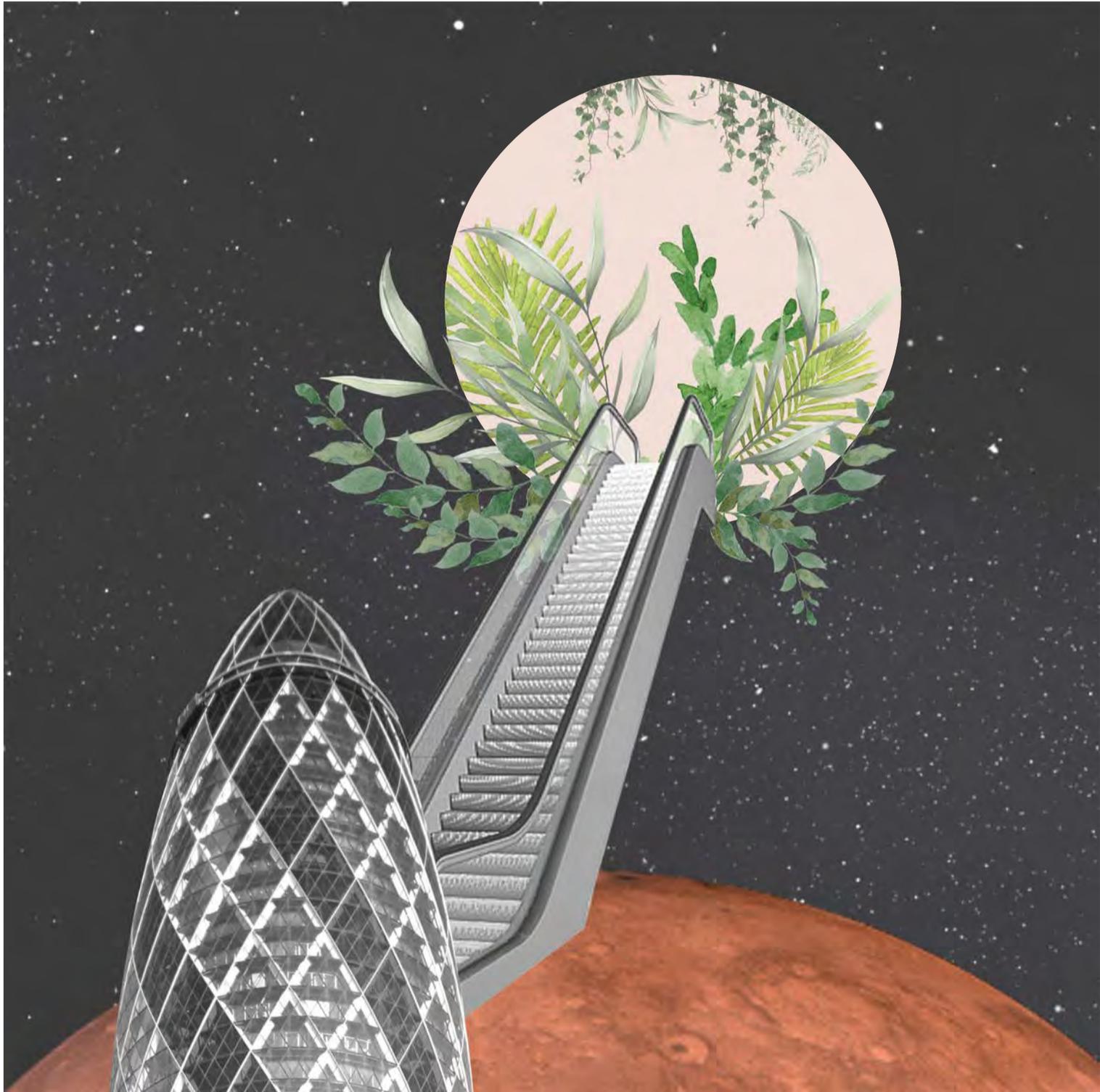
CONCEPTS



The Vertical Market: Adapting the usual market spaces in a way that allows them to function in a high rise.

PROPOSAL

CONCEPTS



The Stairway to Heaven: Ability to escape the city into greener places.

PROPOSAL

CONCEPTS



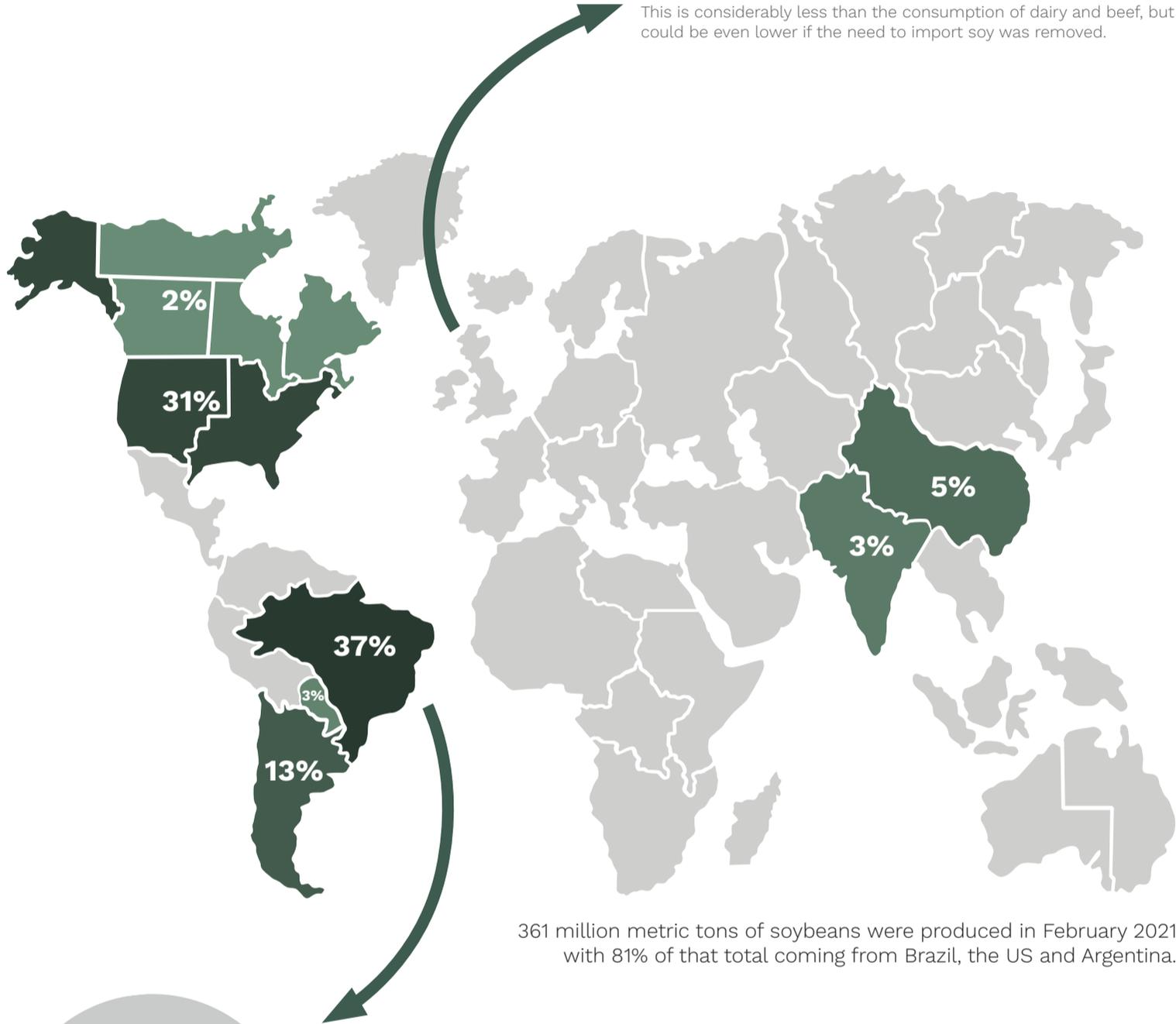
The Green Office: Providing work spaces in a more tranquil environment, helping to alleviate stress.

PROPOSAL

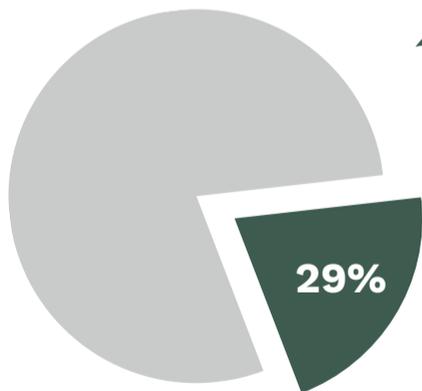
WHY GROW SOY IN LONDON?

Eating tofu once or twice a week contributes **12kg** of CO₂ to a person's annual greenhouse gas emissions.

This is considerably less than the consumption of dairy and beef, but could be even lower if the need to import soy was removed.



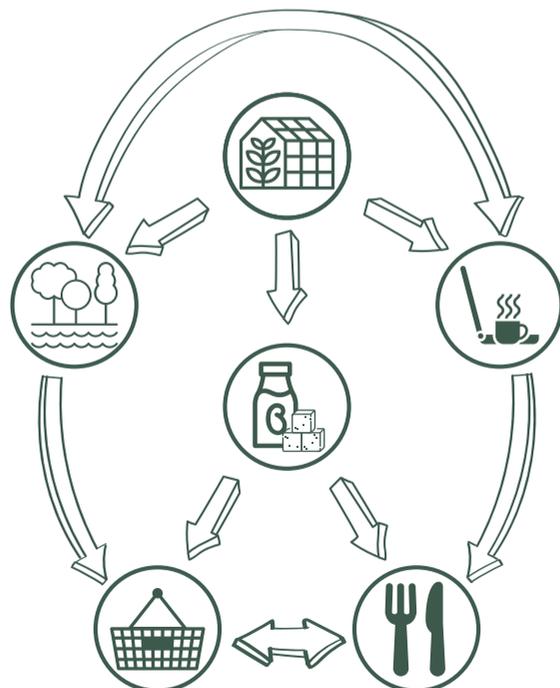
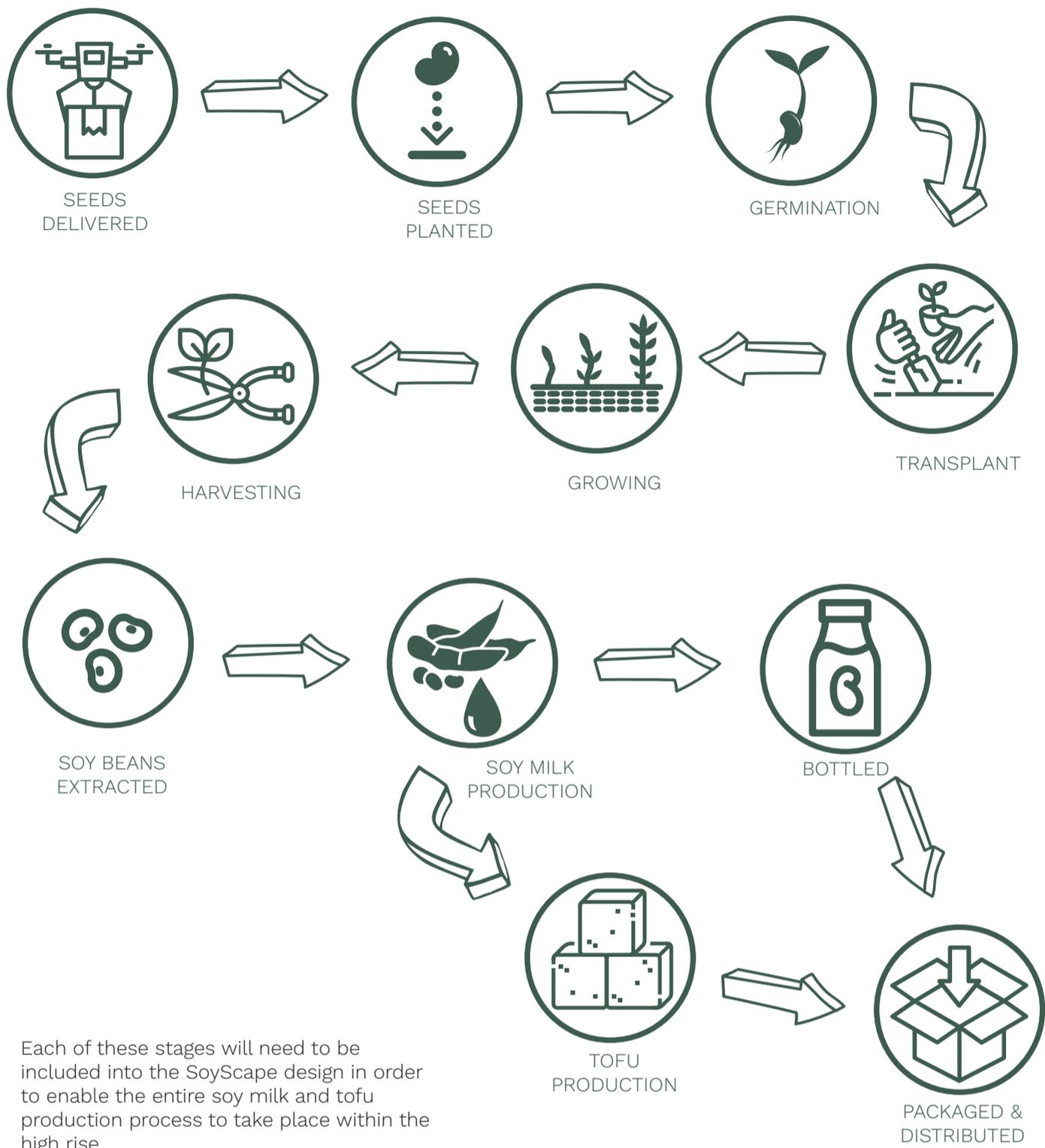
361 million metric tons of soybeans were produced in February 2021 with 81% of that total coming from Brazil, the US and Argentina.



Out of the greenhouse gas emissions in Brazil that are due to deforestation, 29% is related to soy production whilst the remaining 71% is due to cattle ranching.

PROPOSAL

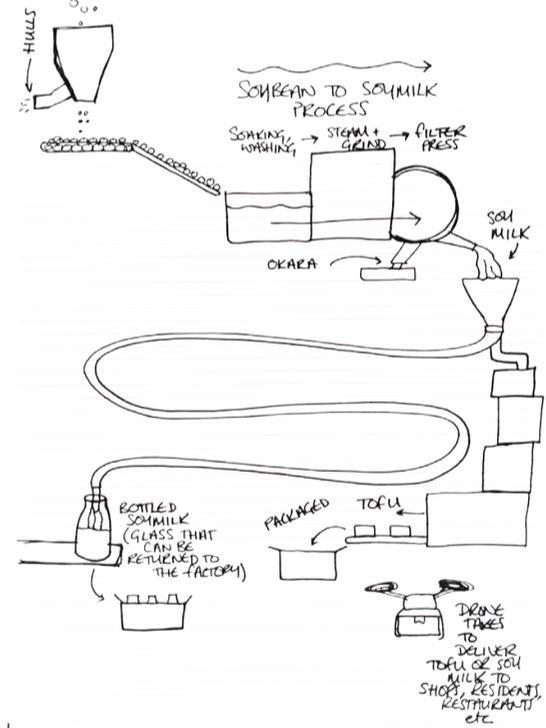
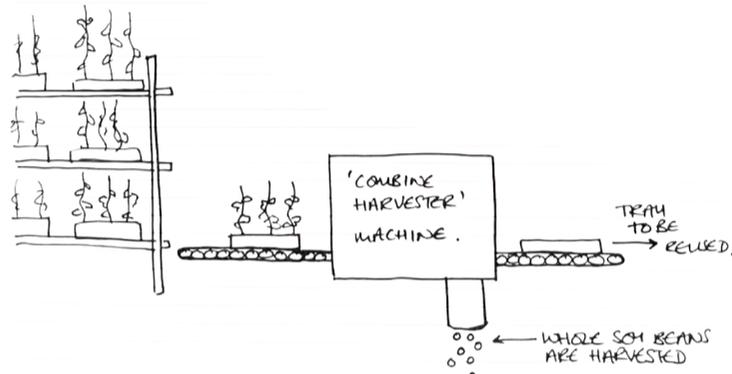
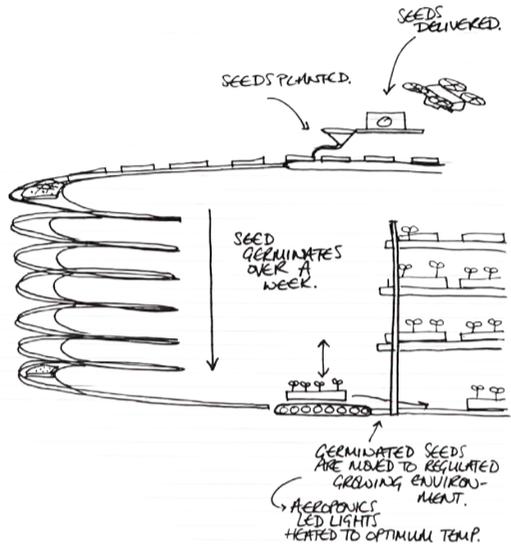
SOY BEAN GROWTH & PRODUCTION



The vertical farm processes will connect with the rest of the building both physically and visually.

PROPOSAL

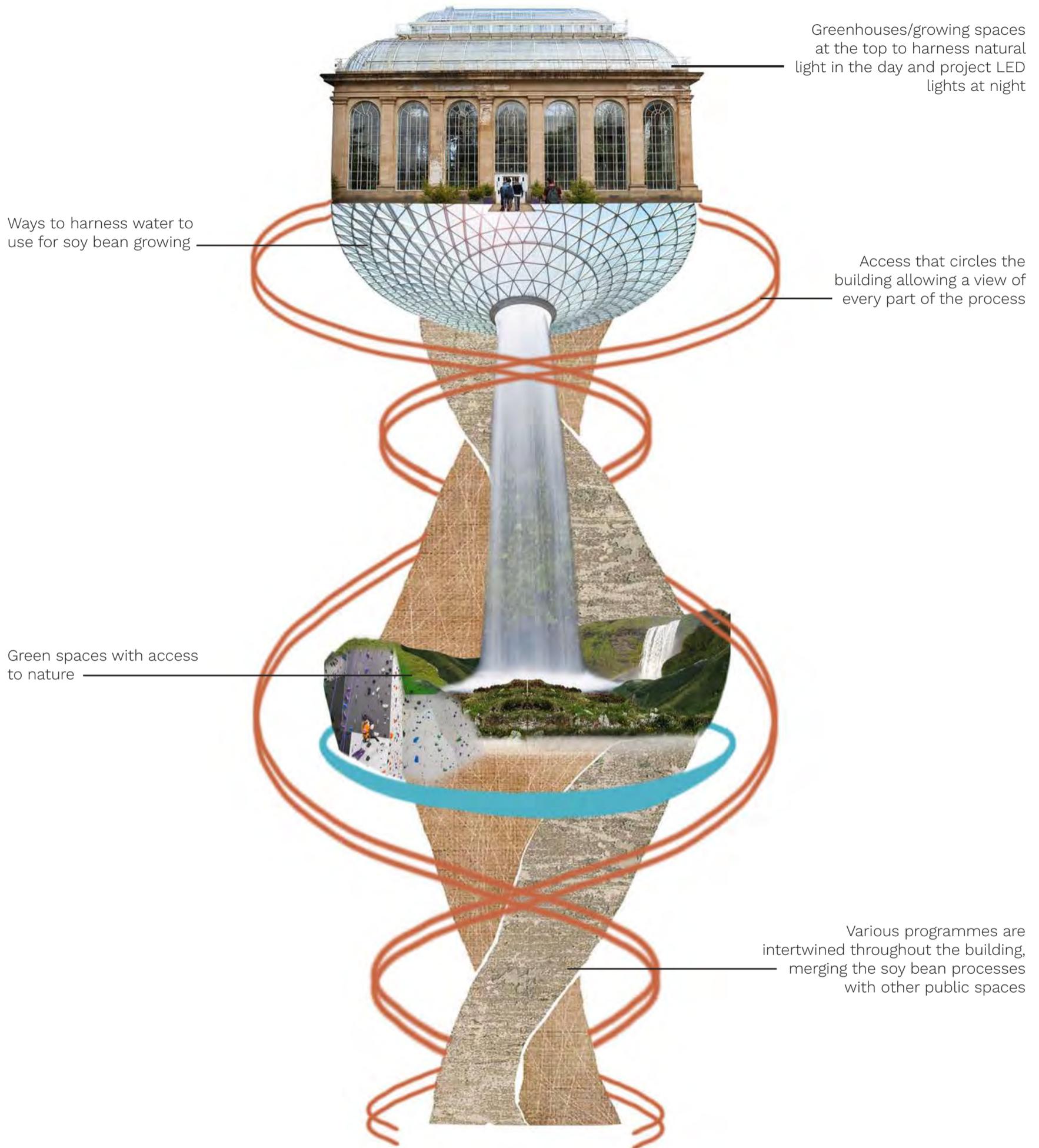
PROCESS SKETCHES



Initial sketches exploring how the soy beans would be delivered, grown, harvest and processed into products such as tofu and soy milk.

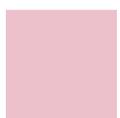
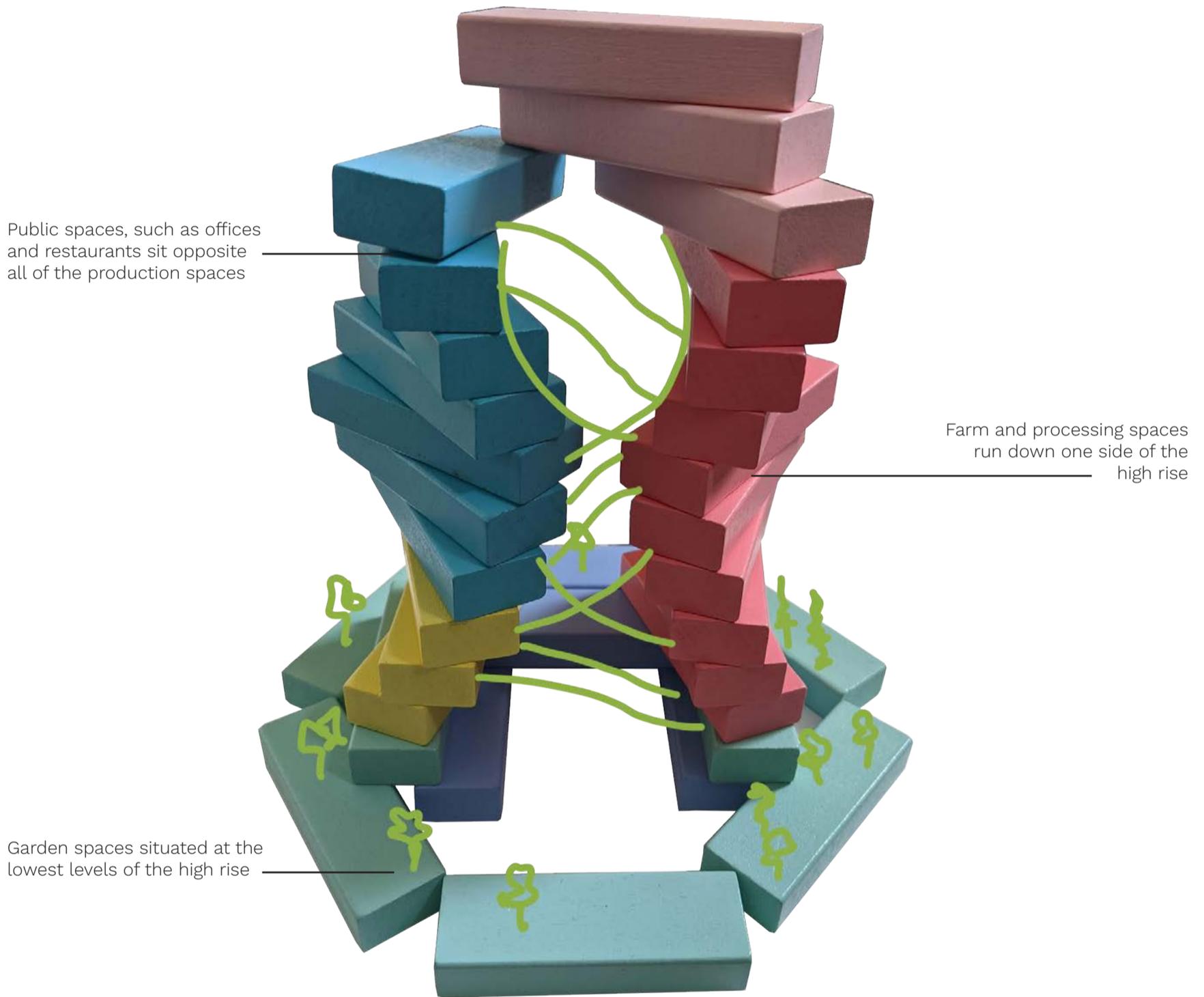
PROPOSAL

COLLAGE



PROPOSAL

INITIAL MODELS



GROW SPACES



FACTORY/
PROCESSING



PUBLIC SPACES



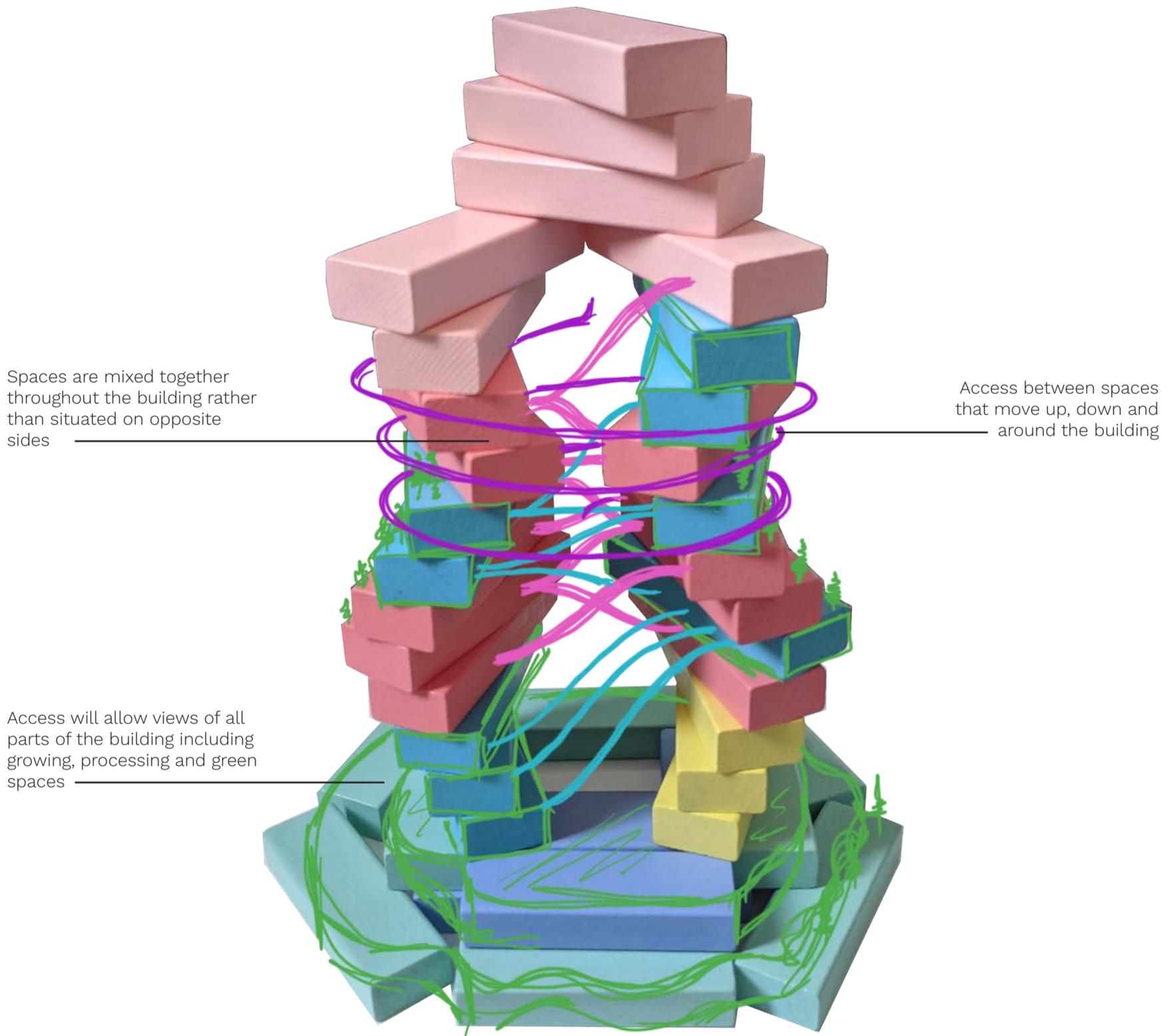
SPACES TO SELL
PRODUCTS



GREEN SPACES

PROPOSAL

INITIAL MODELS



GROW SPACES



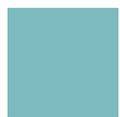
FACTORY/
PROCESSING



PUBLIC SPACES



SPACES TO SELL
PRODUCTS

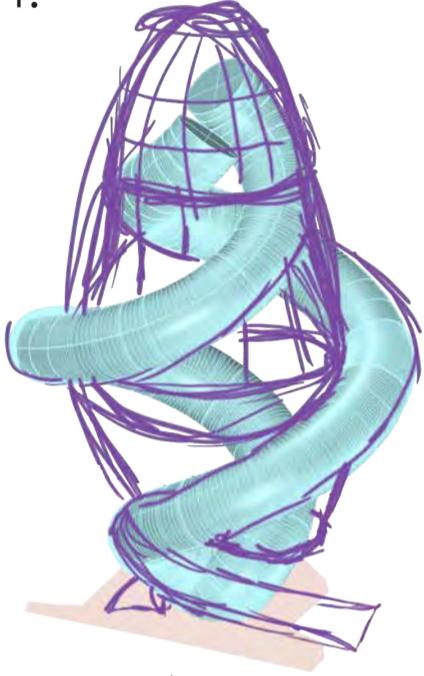


GREEN SPACES

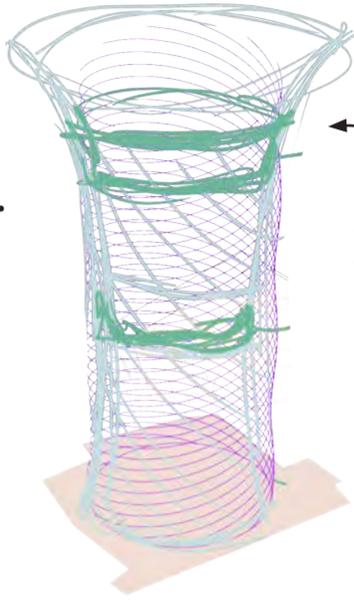
DESIGN

3D MASSING MODELS

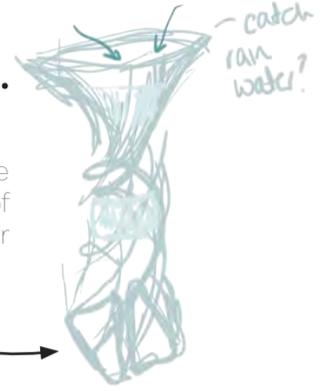
1.



2.



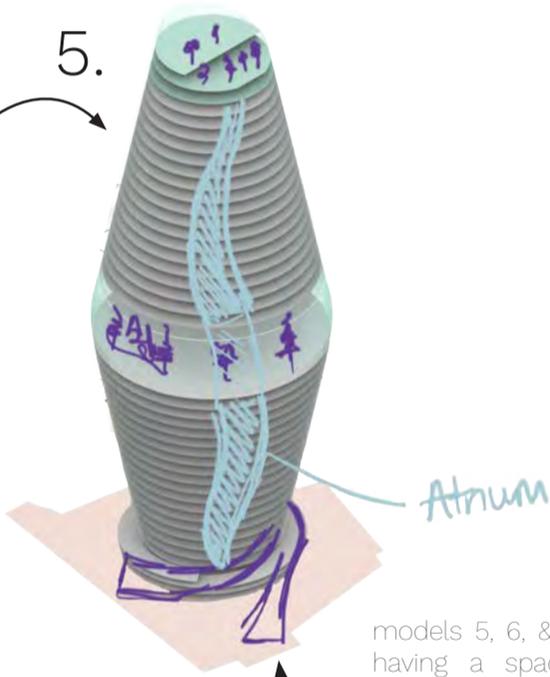
3.



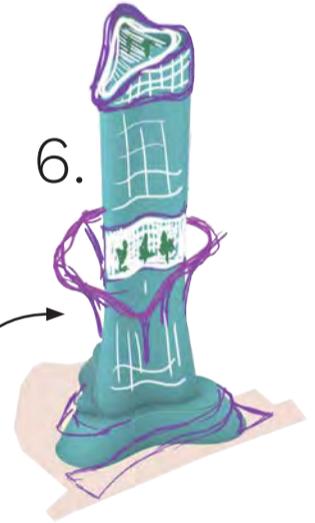
in these two models there was a focus on the kinds of shapes that might allow for the capture of rain water

models 1, 4, 5 & 7 look at integrating more than one programme into the building and how they might be connected

5.



6.

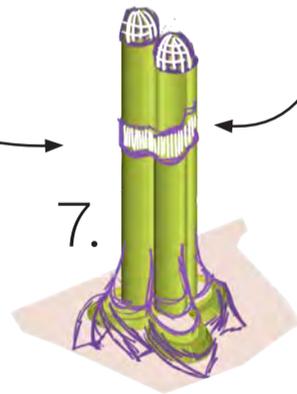


models 5, 6, & 7 looked at having a space spanning approximately 4-6 levels that would act as a interior park, inspired by Changi Airport in Singapore

4.

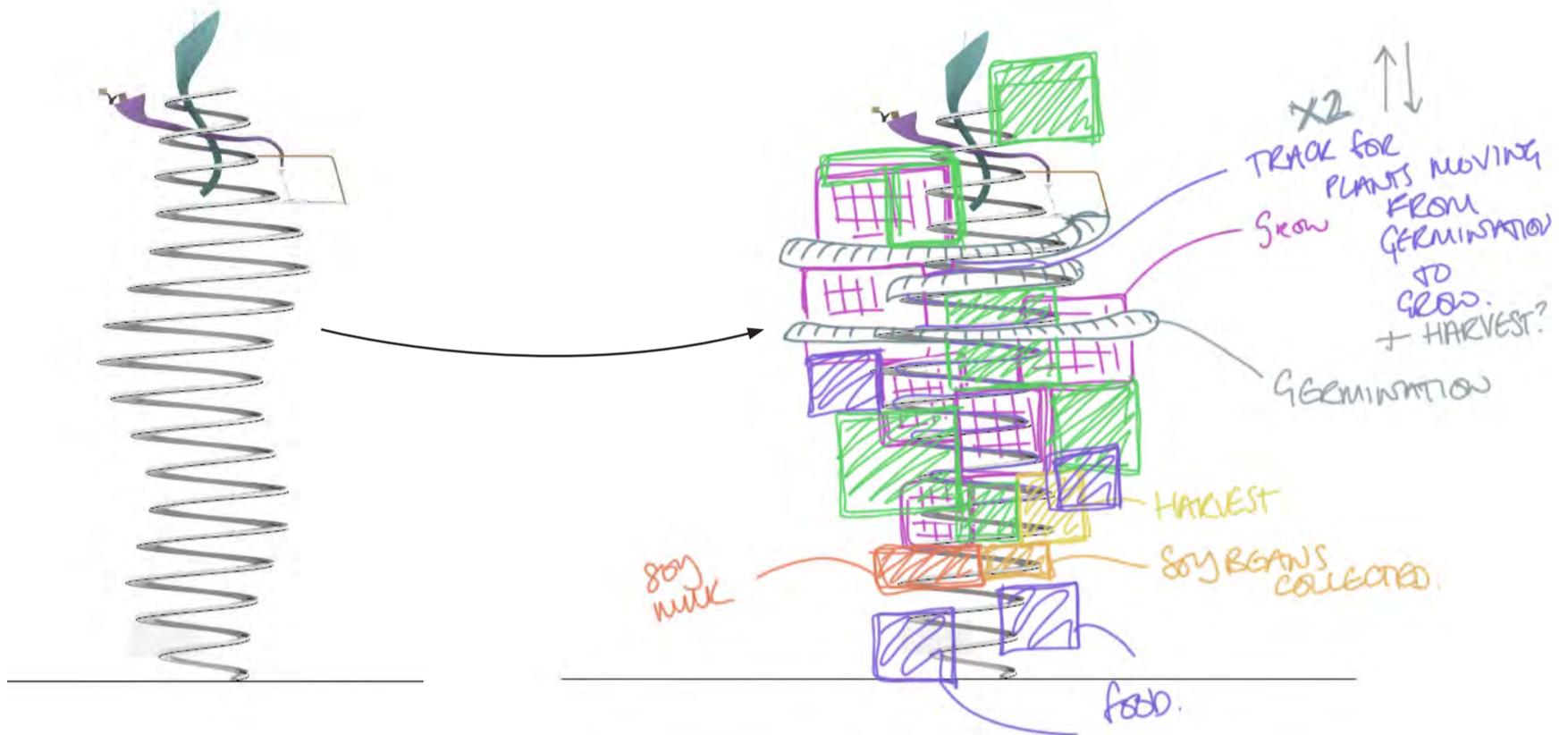


7.



DESIGN

MASSING



central ramp became a key part of the design to allow public access to be intertwined with all the programmes in the building

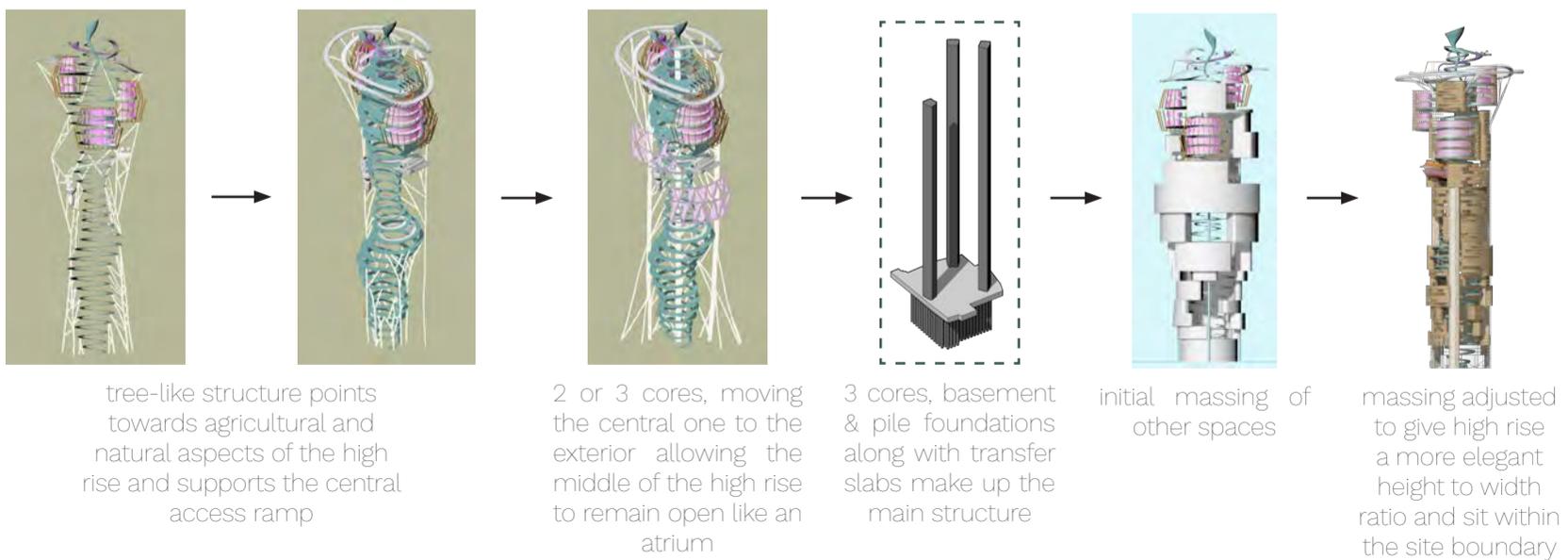
this sketch shows initial ideas surrounding how all of the soy bean processes would be distributed throughout the building



The ramp circling the inside of the Guggenheim allows visitors to see many different views of the building at once.

This idea is carried forward into SoyScape to enable visitors to witness as many of the vertical farm processes as possible from one position.

STRUCTURE & MASSING DEVELOPMENT



tree-like structure points towards agricultural and natural aspects of the high rise and supports the central access ramp

2 or 3 cores, moving the central one to the exterior allowing the middle of the high rise to remain open like an atrium

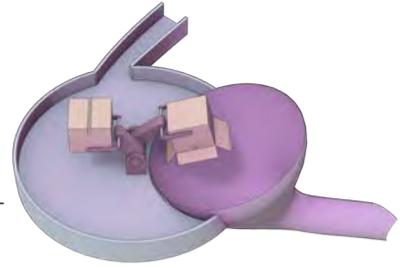
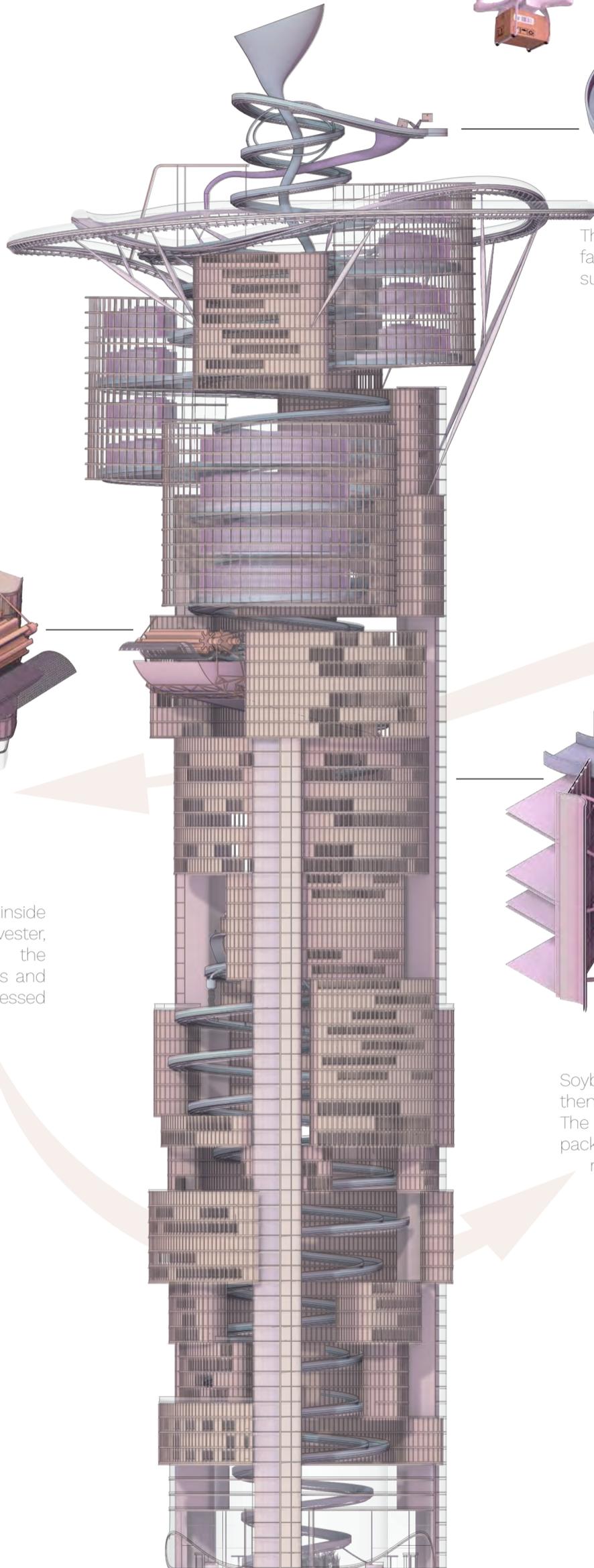
3 cores, basement & pile foundations along with transfer slabs make up the main structure

initial massing of other spaces

massing adjusted to give high rise a more elegant height to width ratio and sit within the site boundary

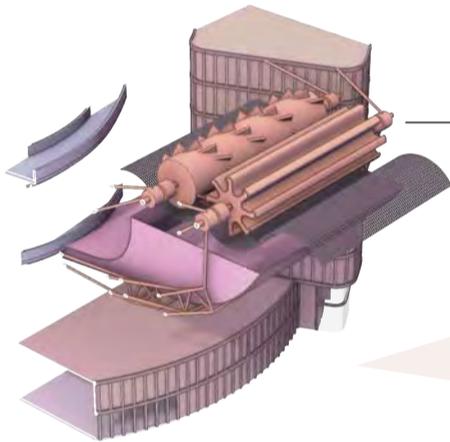
PROPOSAL

SOUTH ELEVATION



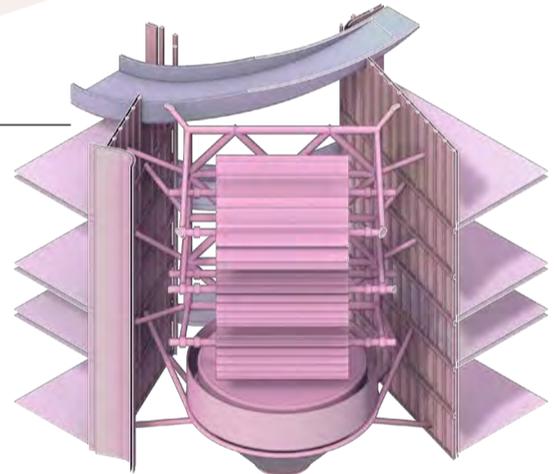
SEED DELIVERY

The first stage of the vertical farm. Soybean seeds and other supplies are delivered by drone at the top.



HARVESTER

Inspired by the mechanics inside a traditional combine harvester, this stage separates the soybeans from their stalks and sends them to be processed into soy milk.

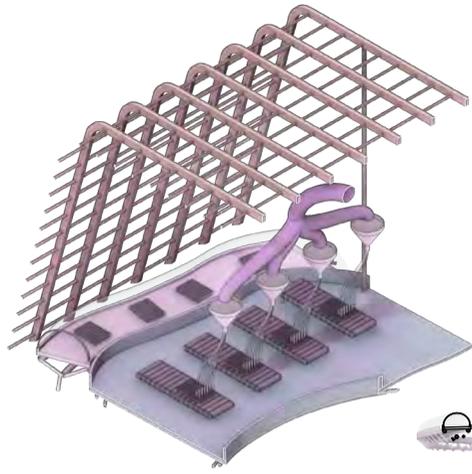


GRINDER

Soybeans are processed and then ground up into soy milk. The residue, okara, is dried and packaged whilst the soy milk moves to the next stage.

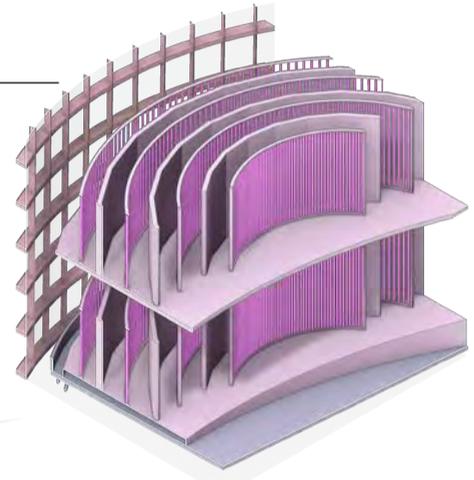
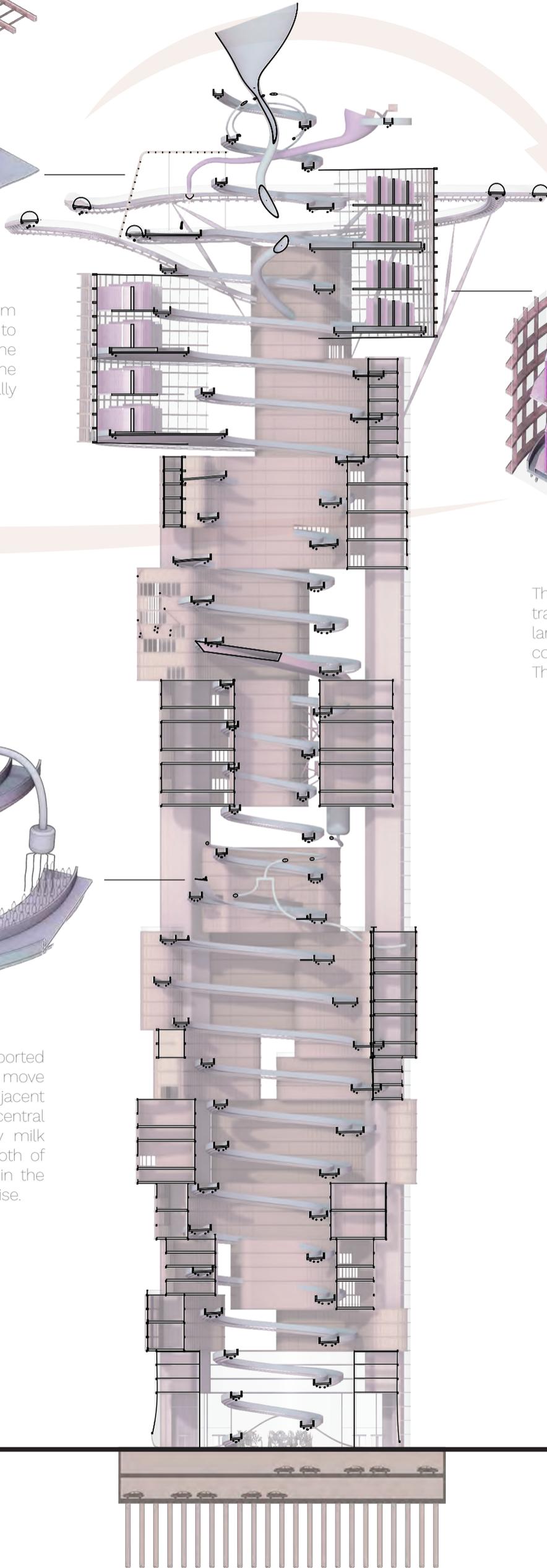
PROPOSAL

SECTION



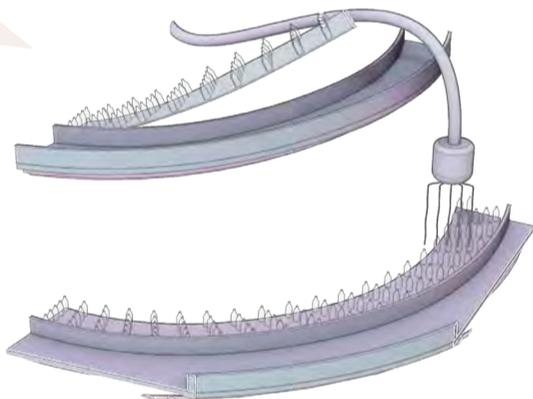
SEED PLANTING

Seeds are transported from delivery and separated to be planted and sent into the germination tube that circles the top of the high rise. This generally takes 1 week,



GROWING

The germinated seeds are transplanted into one of the three large growing spaces where they continue to grow into soybeans. This growth is supported by LED lighting, nutrients and water.

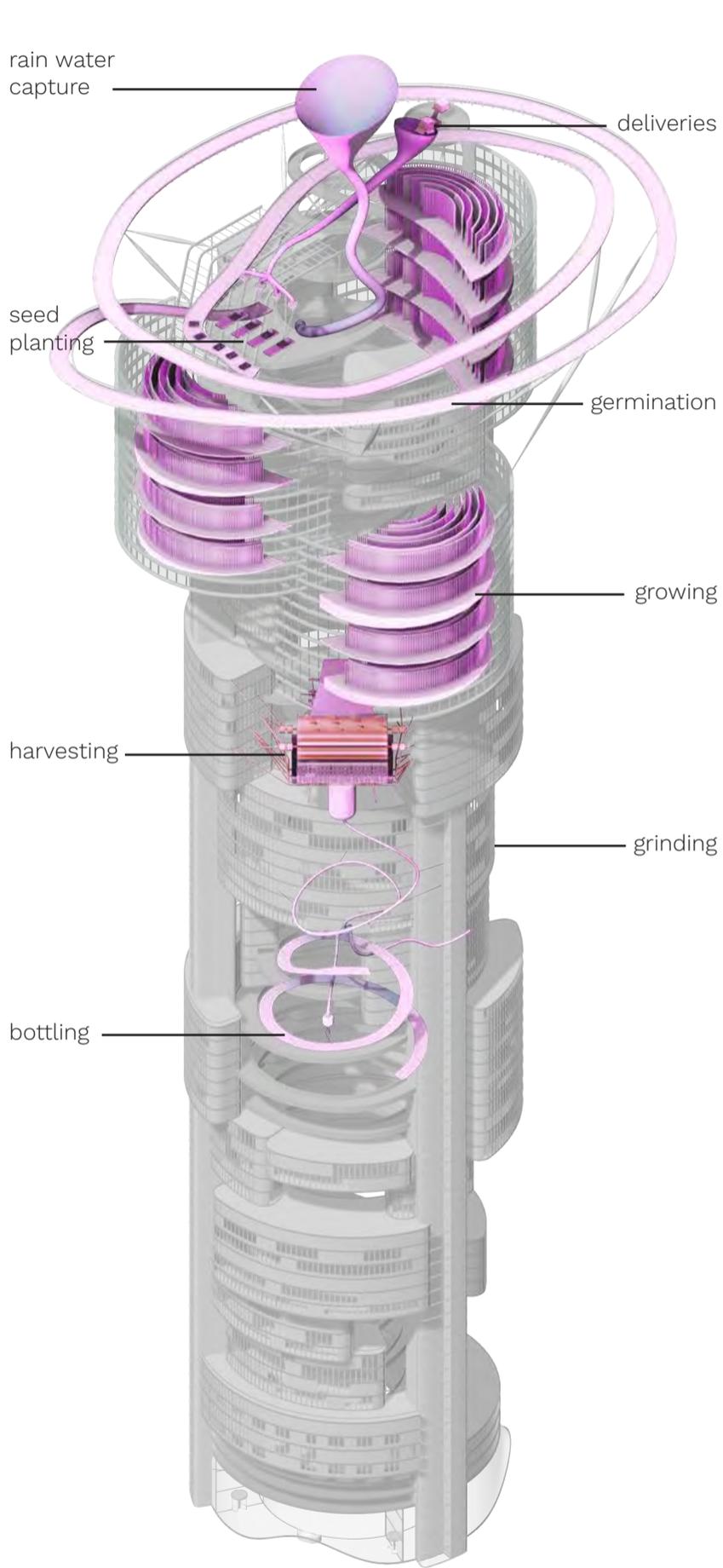


BOTTLING

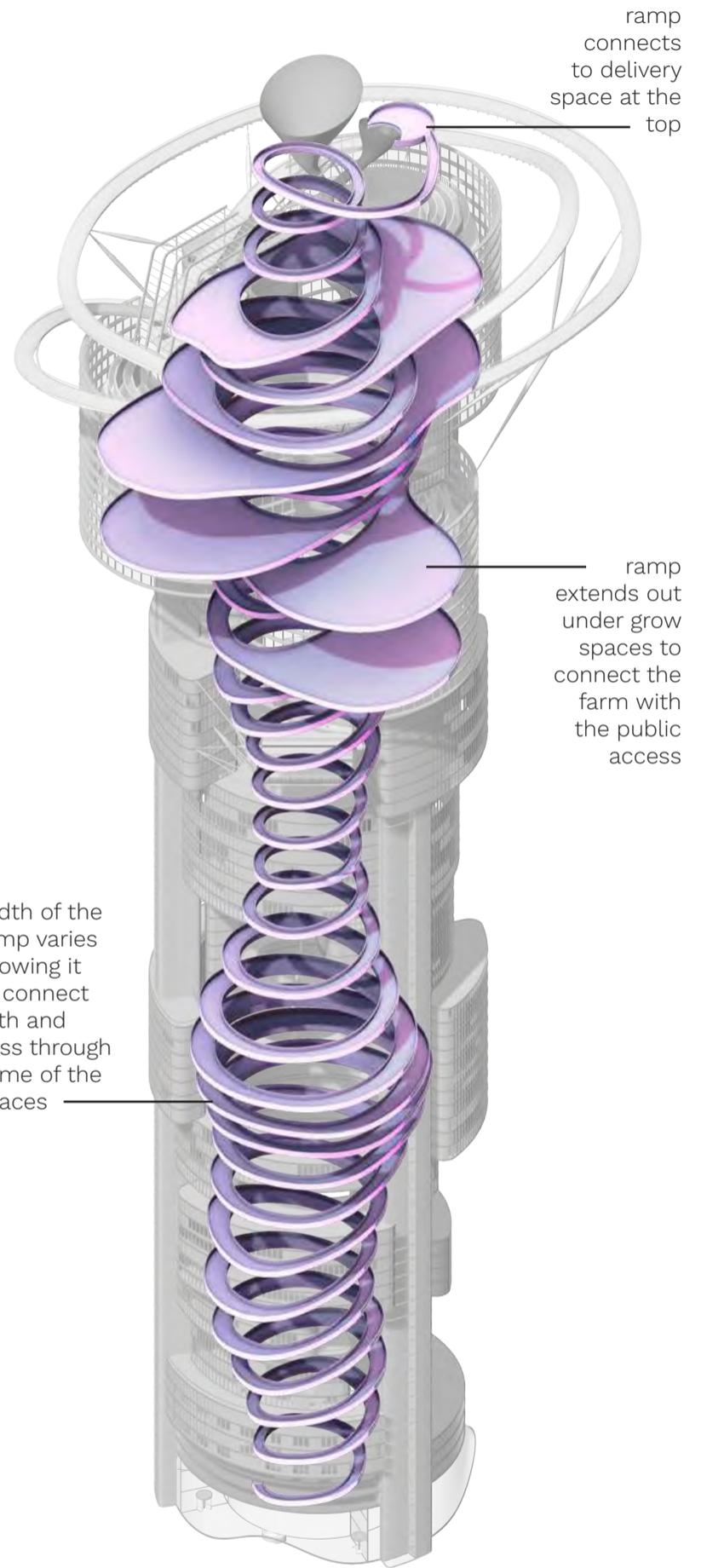
The soy milk is transported via tubes to bottles that move along a conveyor belt adjacent to a small portion of the central access ramp. Some soy milk is processed into tofu. Both of these products are sold in the shops within the high rise.

PROPOSAL

BUILDING COMPONENTS



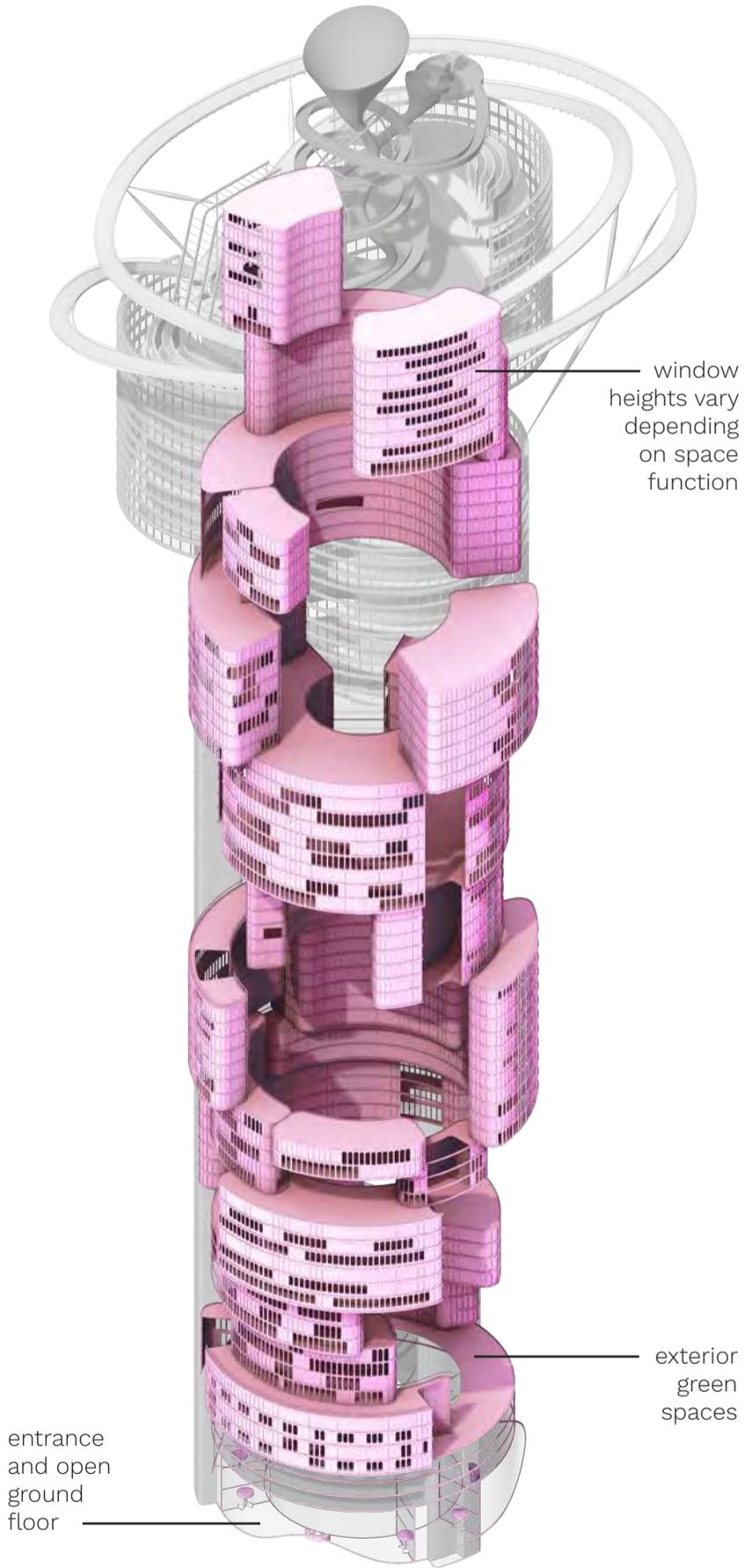
SOY BEAN FARM & PROCESSES



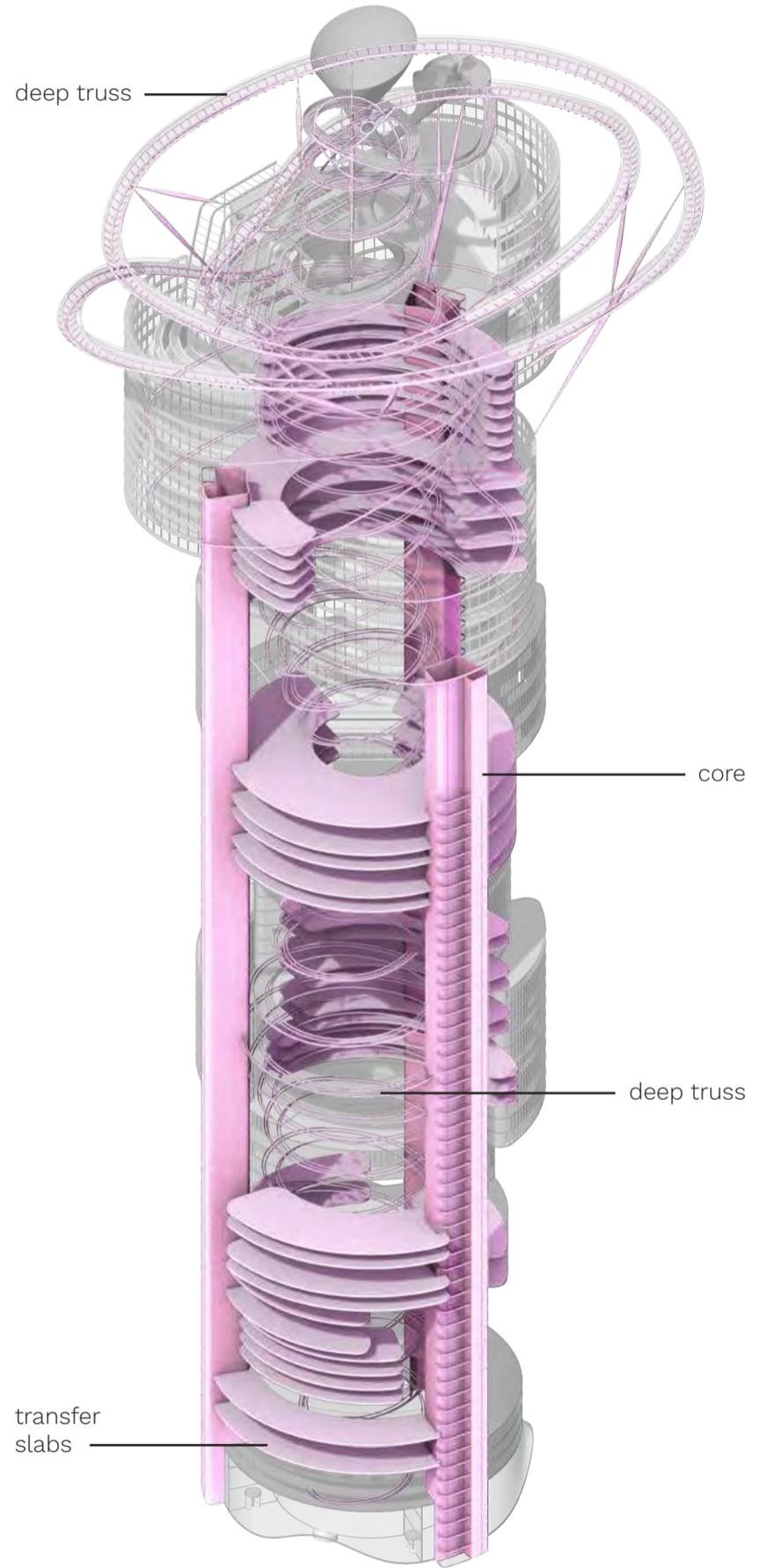
PUBLICLY ACCESSIBLE RAMP

PROPOSAL

BUILDING COMPONENTS



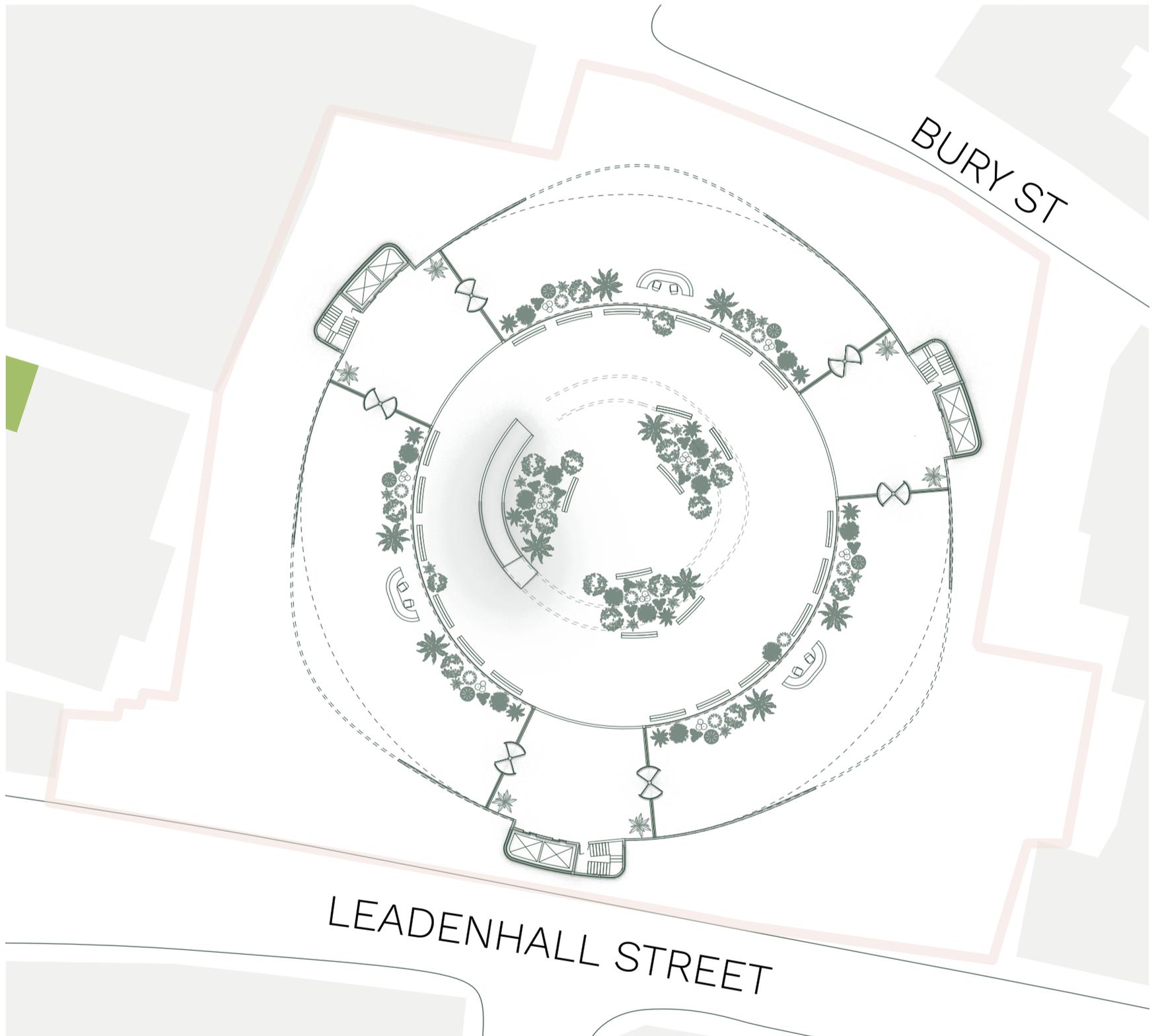
PUBLIC SPACES INCLUDING SHOPS, WORK SPACES & GARDENS



STRUCTURE

PLAN

GROUND FLOOR



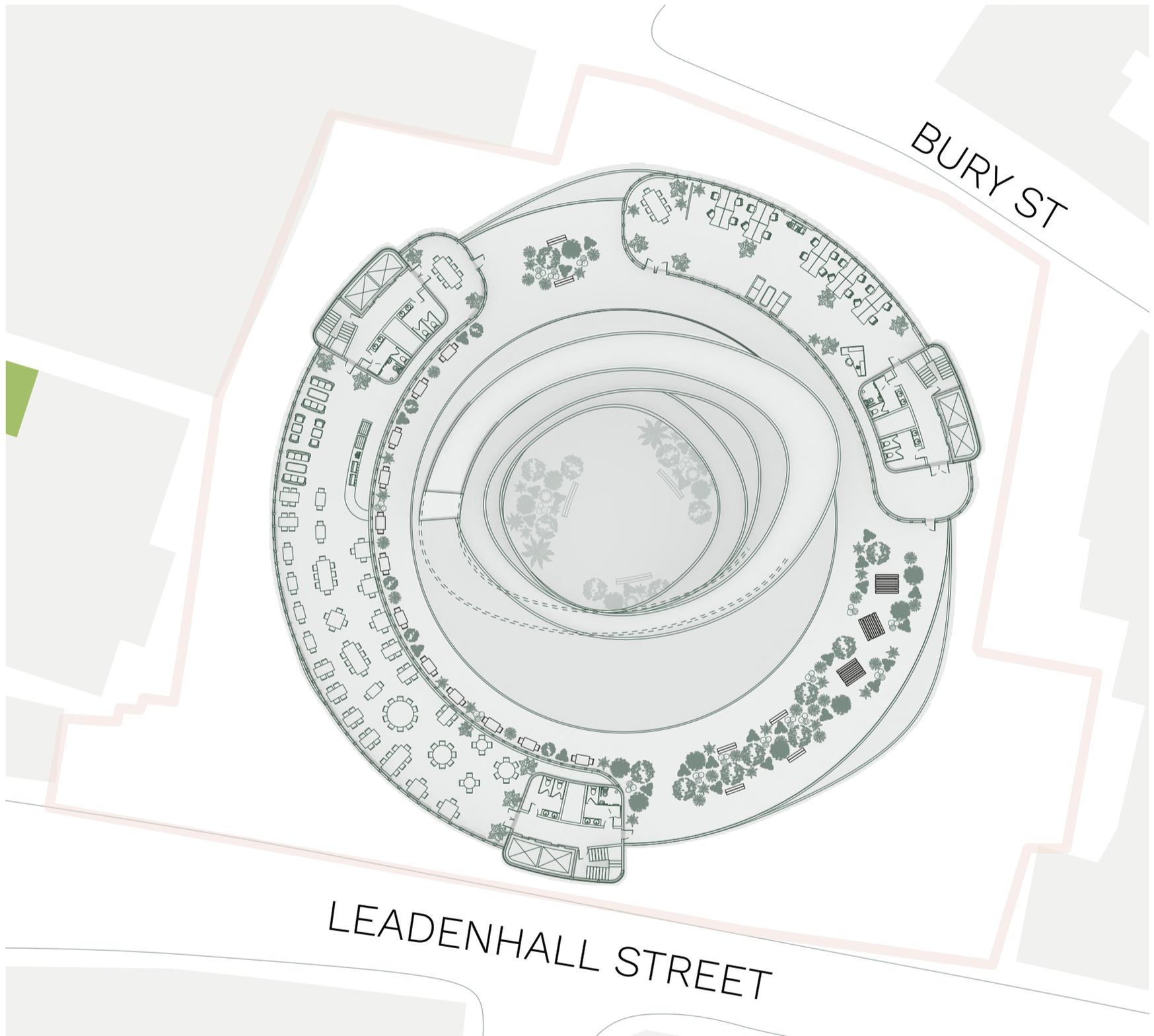
1:400



The ground floor's three entrance points are located underneath the extruded parts of the façade, shown in dashed lines here. The ramp begins at the centre of these entrances amongst plants and trees.

PLAN

FIRST LEVEL OF PUBLIC SPACES



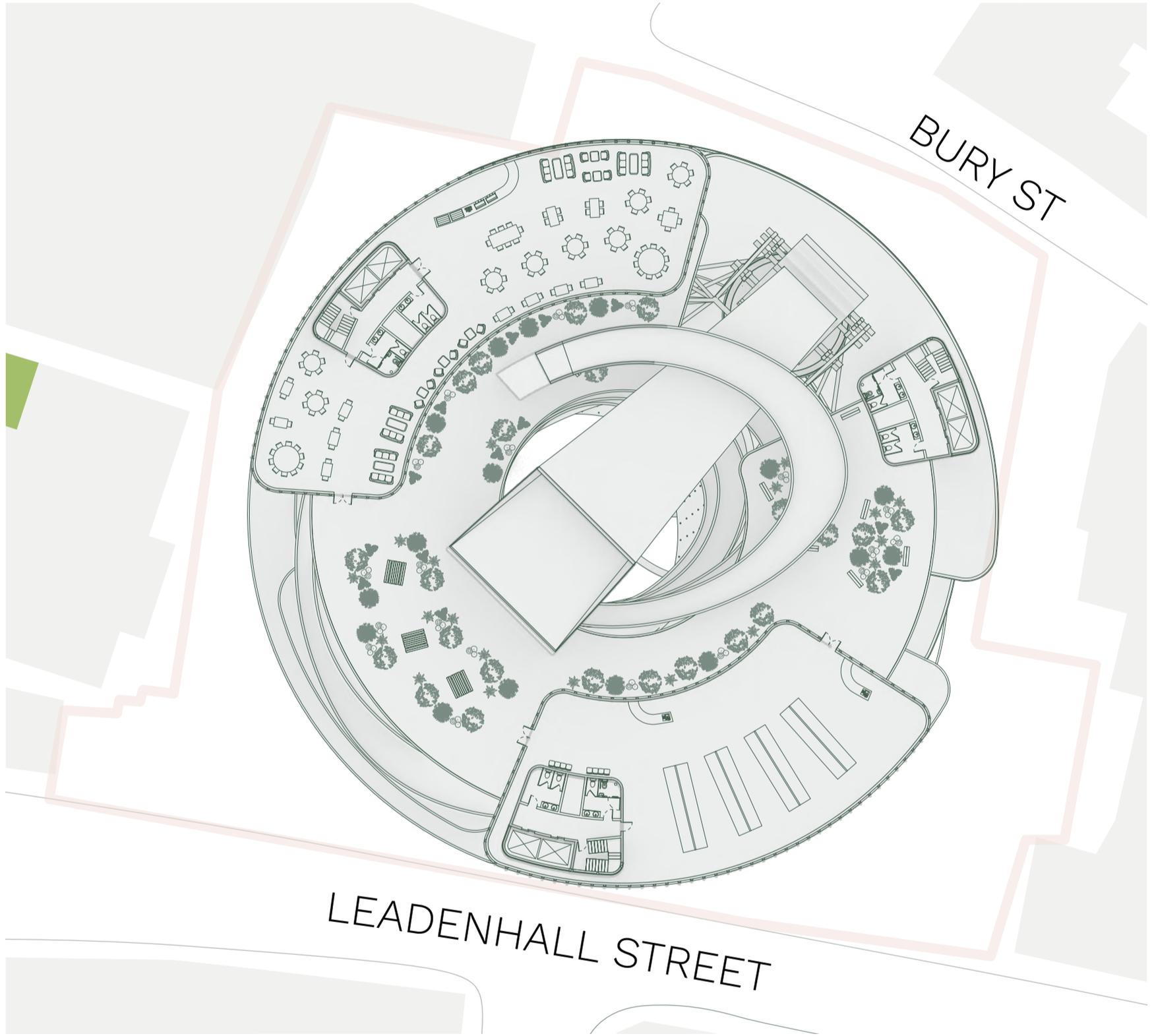
1:400



Moving up the building, the lower levels consist mainly of public spaces such as restaurants and work spaces with gardens and greenery present on the exterior spaces. These are all publicly accessible.

PLAN

PUBLIC SPACES & SOY BEAN TRANSFER
TO GRINDER



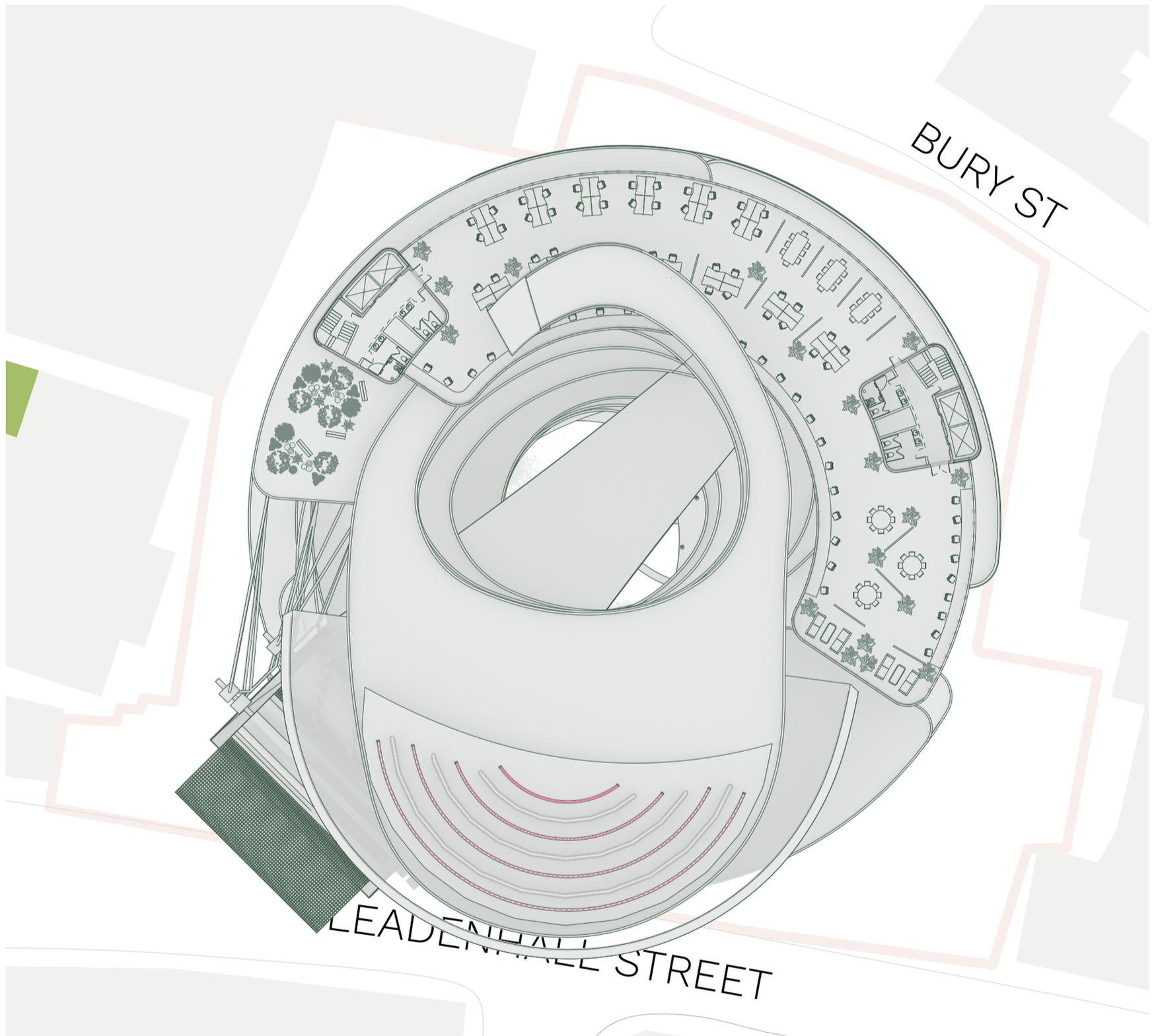
1:400



This plan shows how parts of the vertical farm and food processing is intertwined with the public spaces. More exterior green spaces can be seen at this level too.

PLAN

GROW SPACE & WORK SPACE



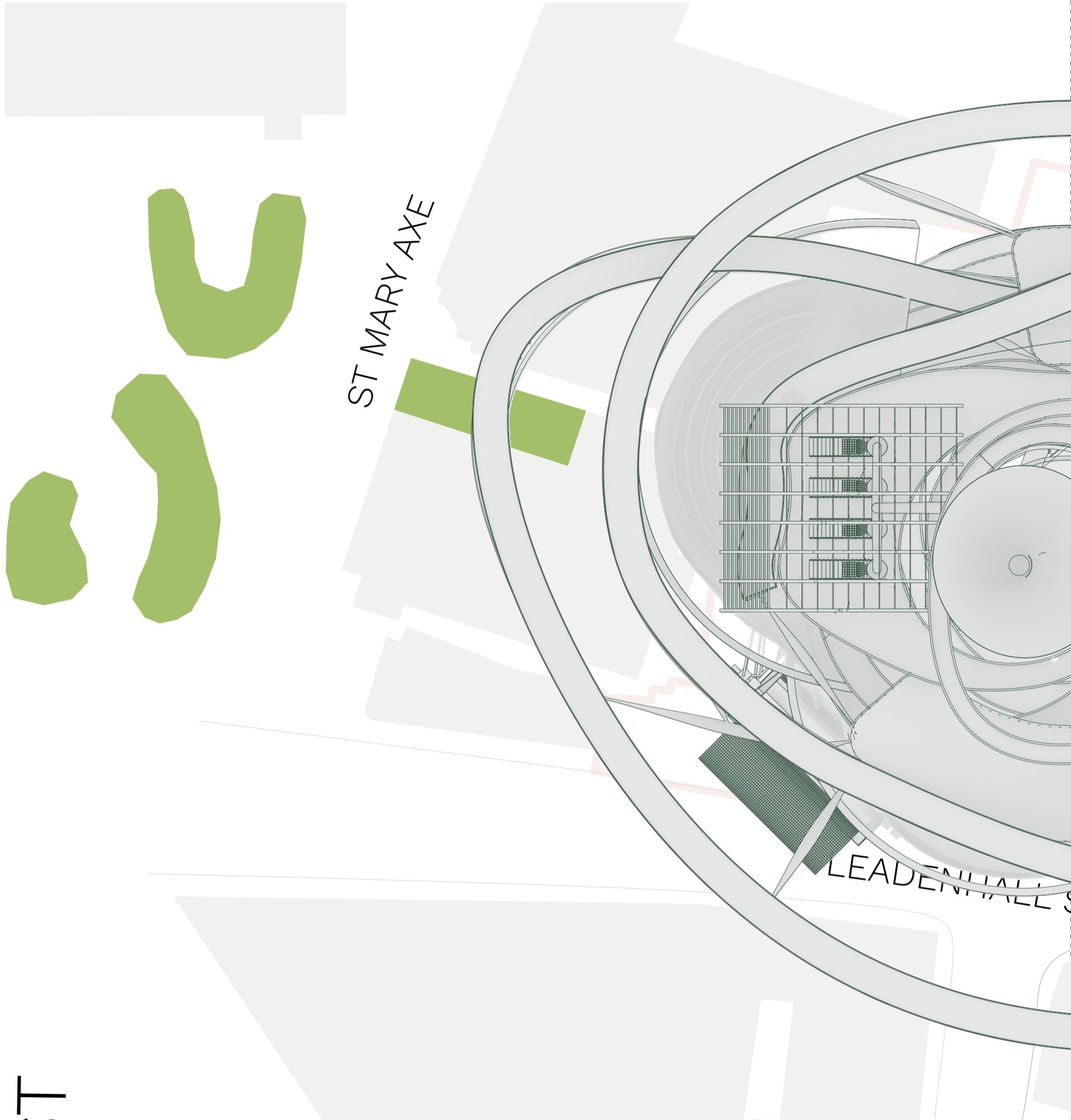
1:400



The ramp to cuts into the work spaces situated on this floor, allowing the growing spaces, shown at the south of this plan, to connect with these spaces.

PLAN

THE START OF THE FARM

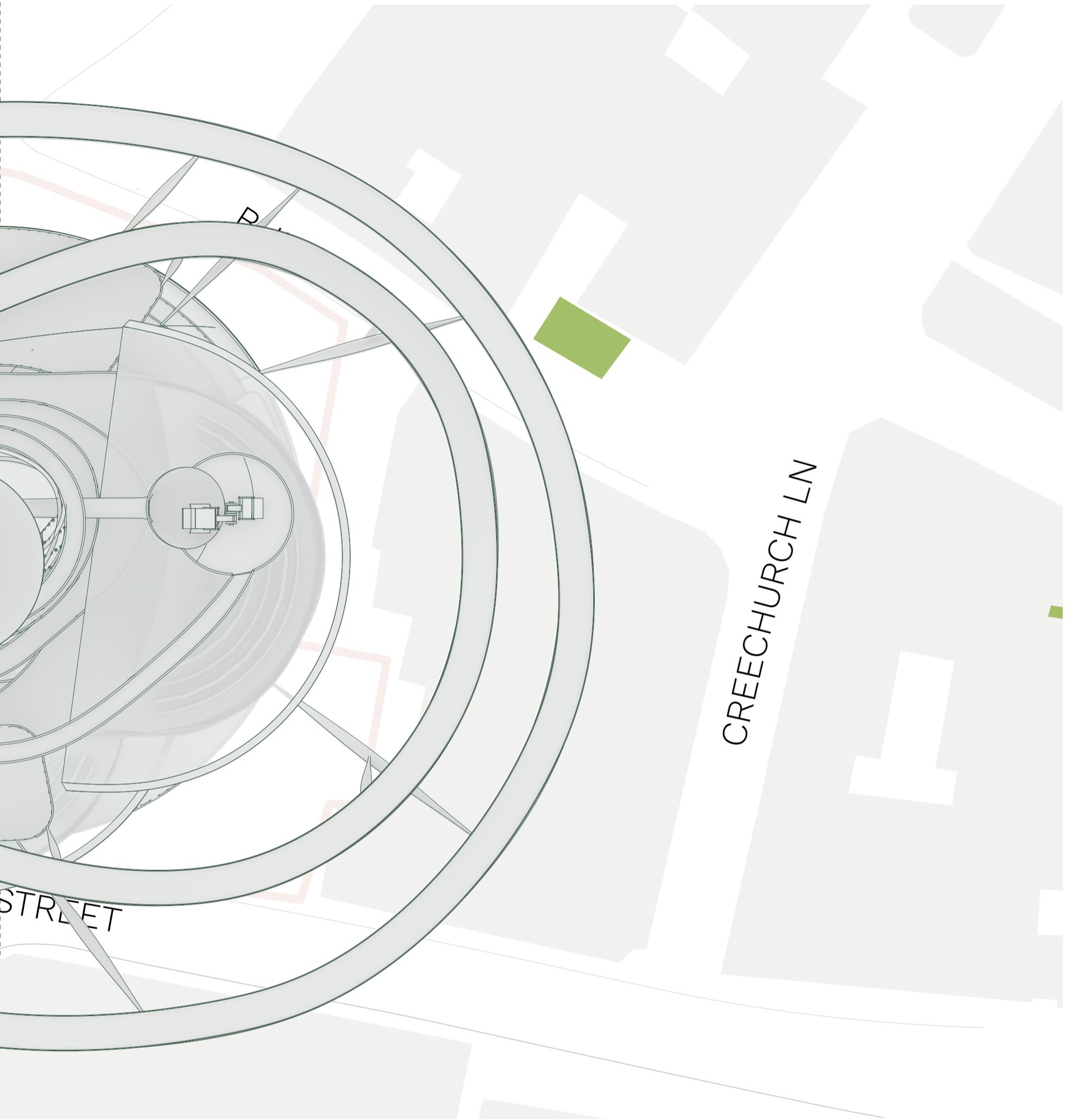


1:400

This top level plan, 300m above ground, shows the end of the ramp and the beginning of the vertical farm processes.

PLAN

THE START OF THE FARM



The top of the building does not interfere with the buildings around it. The germination loop and growing spaces are lit 24 hours a day.



SECTIONS

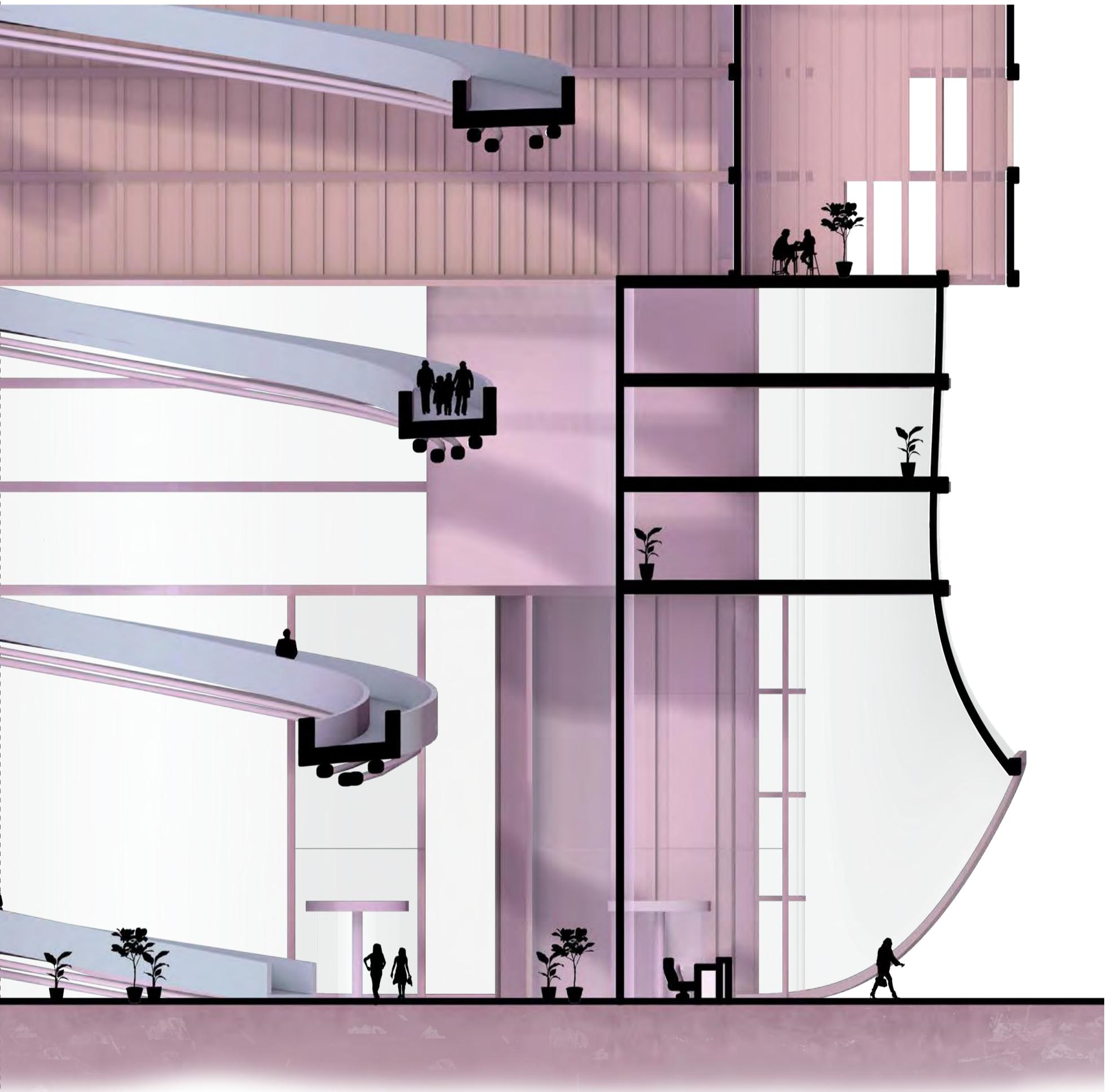
ENTRANCE & LOWER LEVELS



The ground floor has three entry points that guide you to information desks, access to the core and to the ramp situated at the centre of the building.

SECTIONS

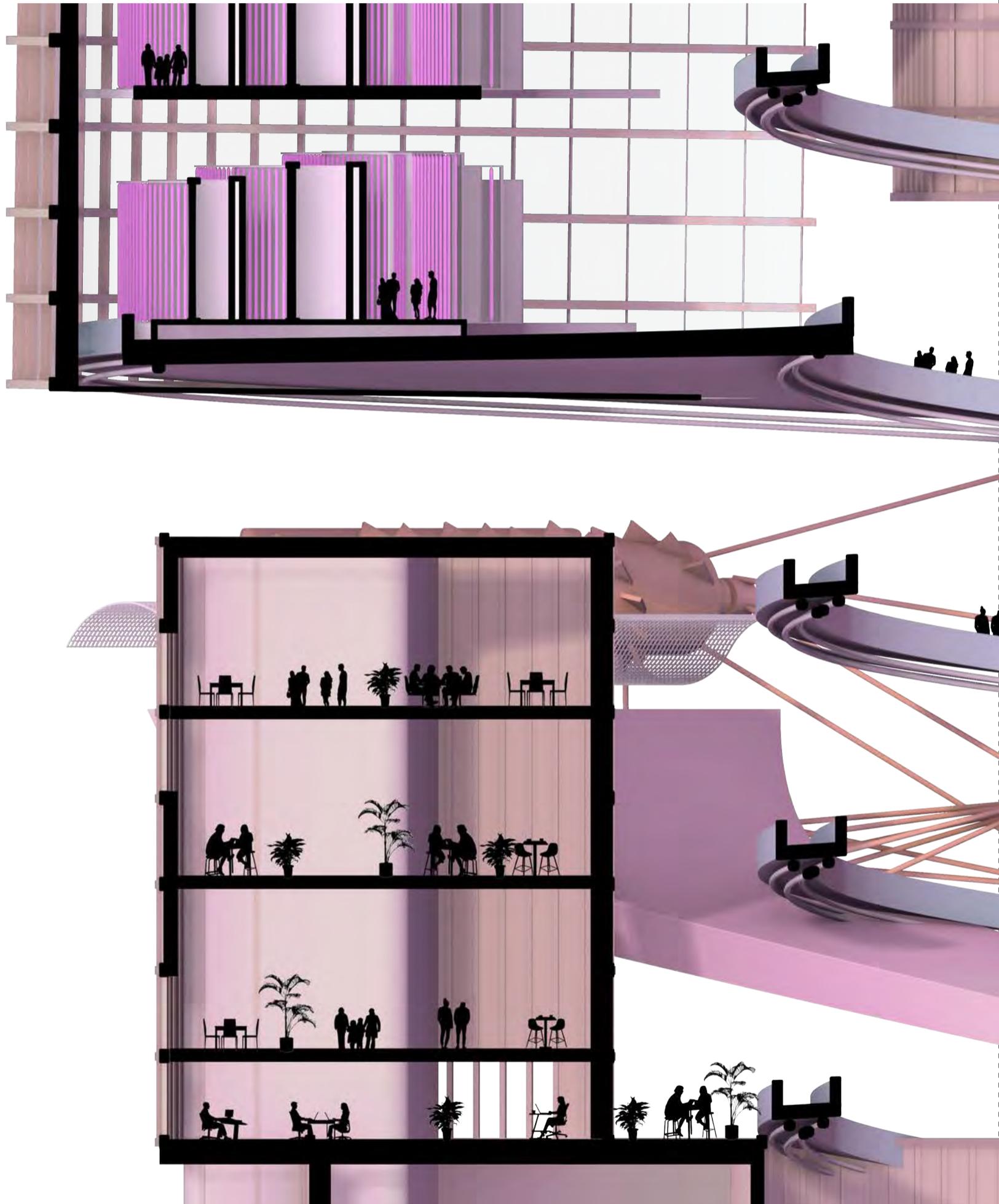
ENTRANCE & LOWER LEVELS



The stairs and lifts situated in each core allow access to the spaces on the floors above that sit around the vertical farm processes. The building is completely accessible to the public apart from the spaces that require controlled environments.

SECTIONS

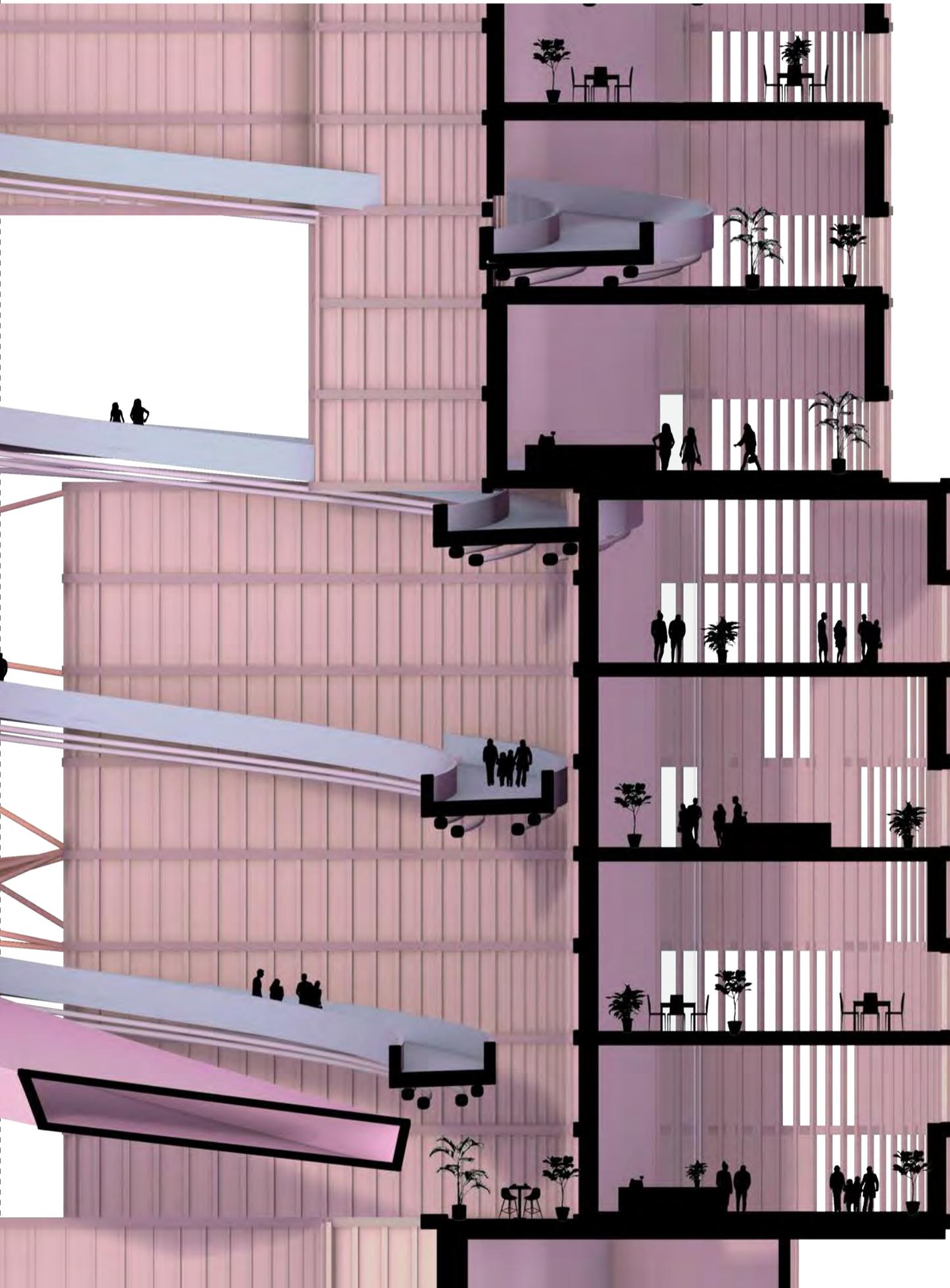
MIXED SPACES



The harvesting and grinding processes are connected via the large chute in the centre. Each of these elements can be seen from the various public spaces at this level.

SECTIONS

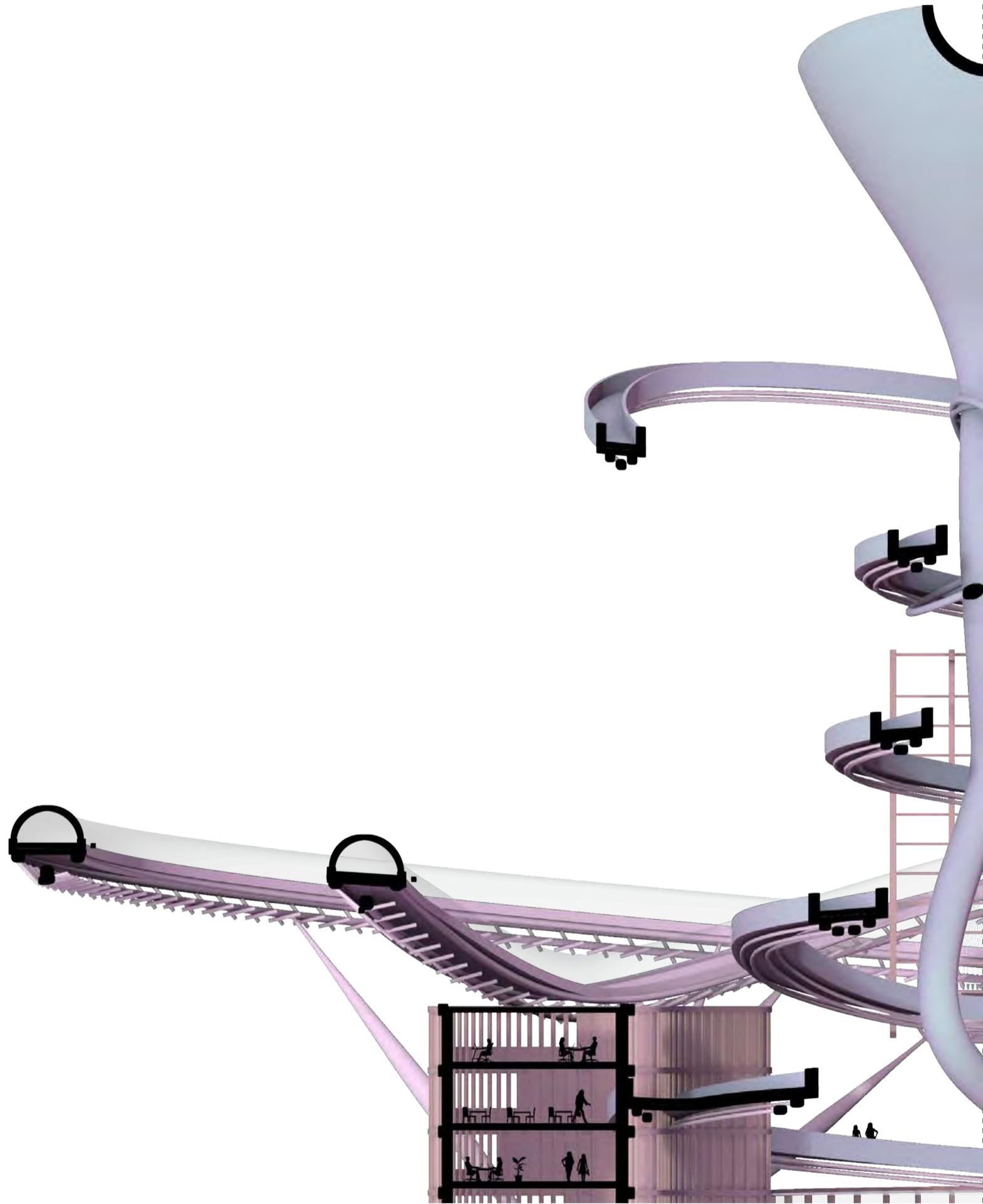
MIXED SPACES



These public spaces include work spaces, green spaces, restaurants, cafés and shops. The window sizes vary depending on the function of the space inside.

SECTIONS

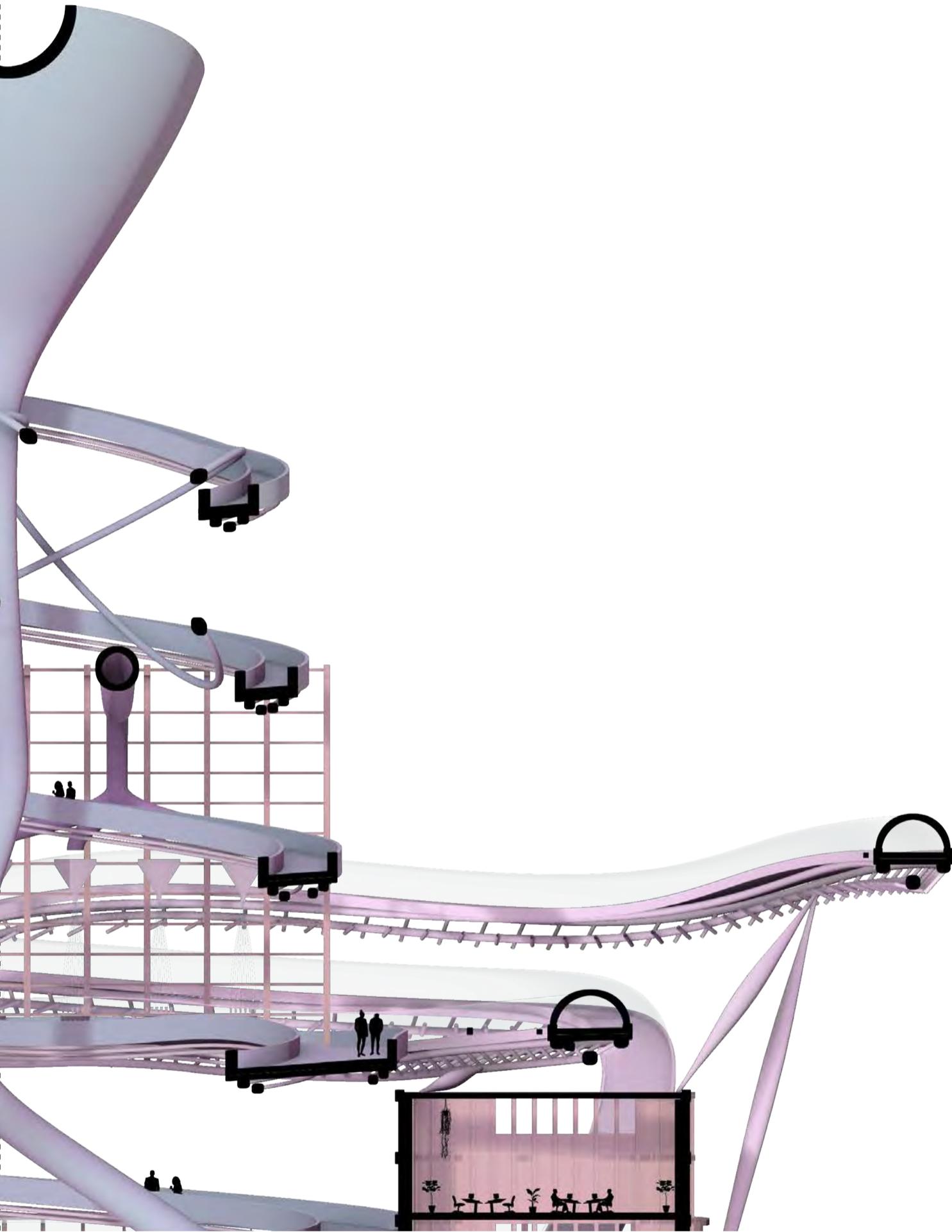
START OF THE FARM



The enclosed spaces at the top of the farm are generally reserved for office spaces, labs and other staff areas that help enable the SoyScape business to run properly.

SECTIONS

START OF THE FARM



Public visitors are still able to access the ramp at this level and can experience every process of the farm from beginning to end. This pushes people towards reconnecting with nature and the journey of their food.

VISUALISATIONS

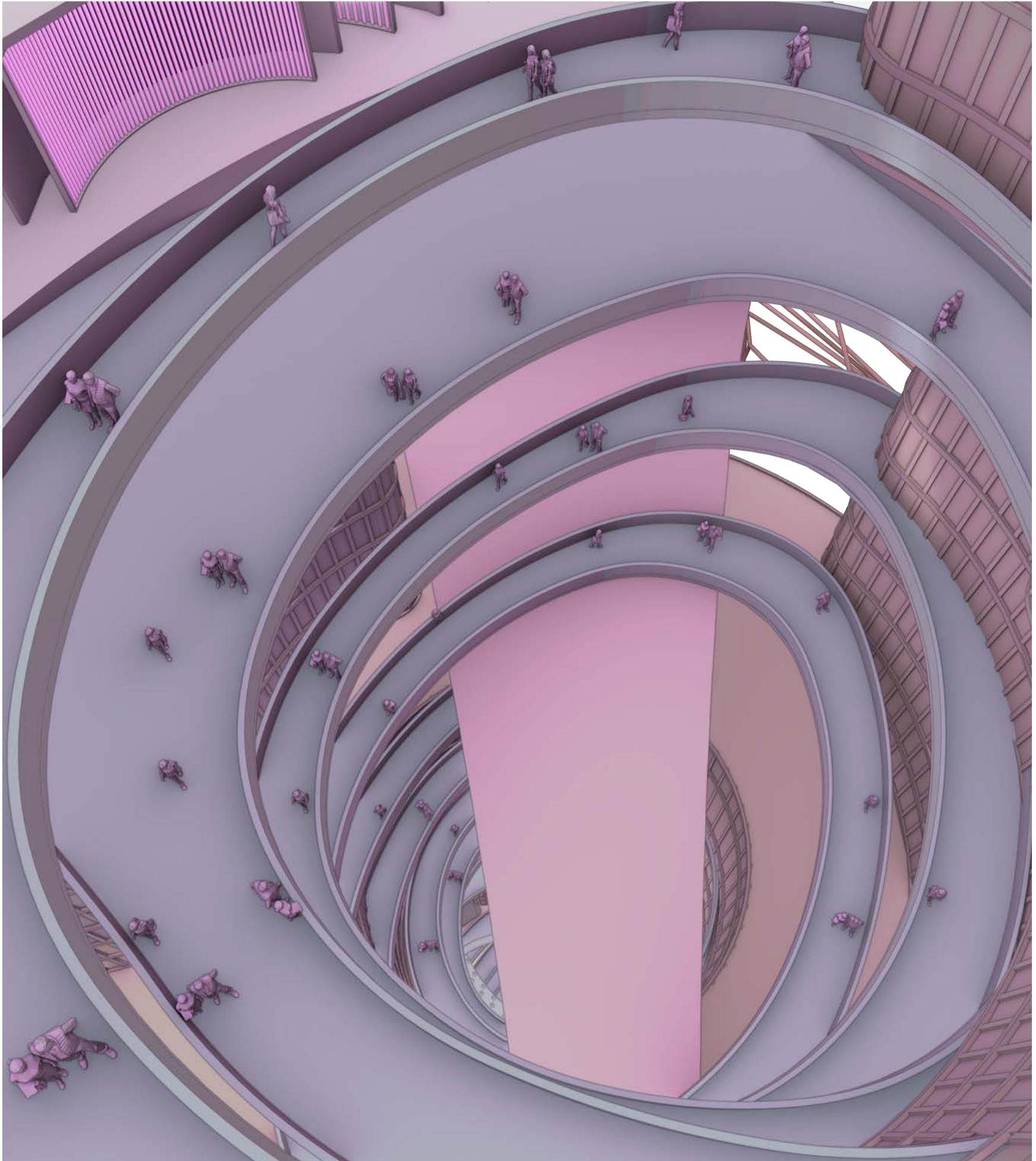
ENTRANCE



The entrance gives access to the central ramp by passing through the revolving doors that sit next to each core. There are information desks to guide you to the spaces above.

VISUALISATIONS

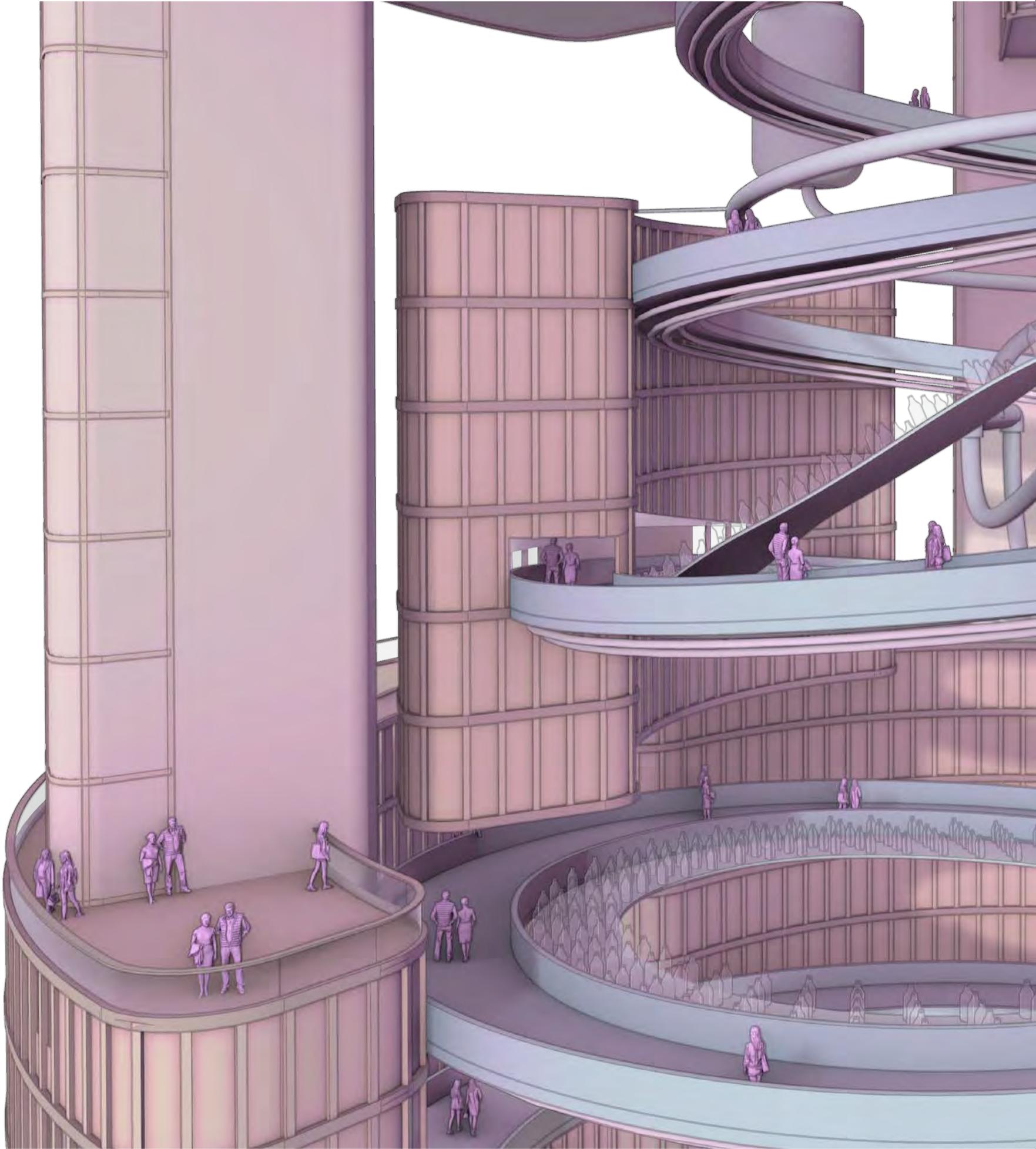
ATRIUM



The atrium allows those inhabiting the vertical farm and the other joining spaces to have a constant view of the processes and activities taking place on the other side of the building and other levels.

VISUALISATIONS

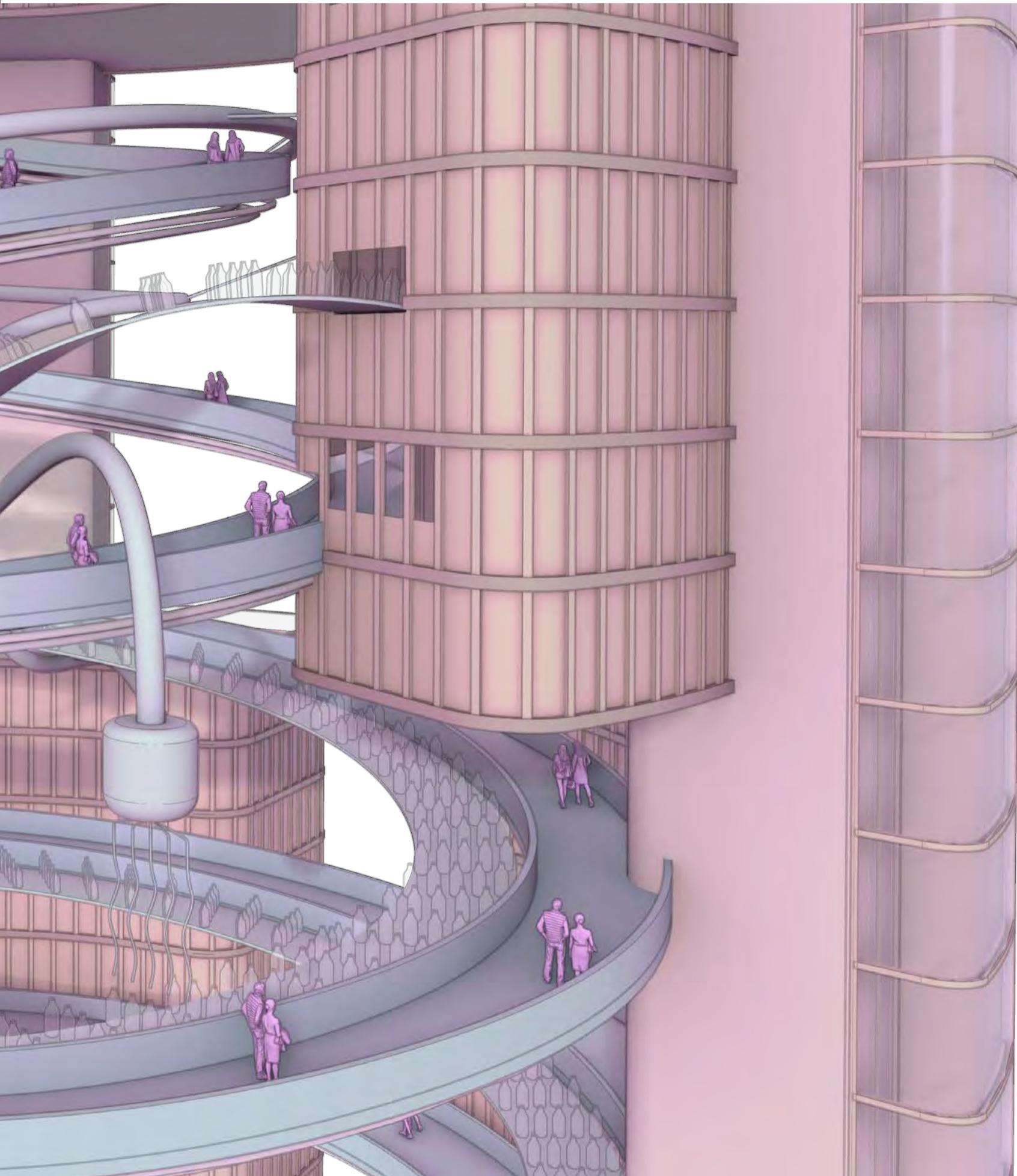
BOTTLING



There are multiple exterior spaces that take on the form of gardens and terraces, containing an abundance of plants and nature. They provide another place from which to observe the processes of the vertical farm.

VISUALISATIONS

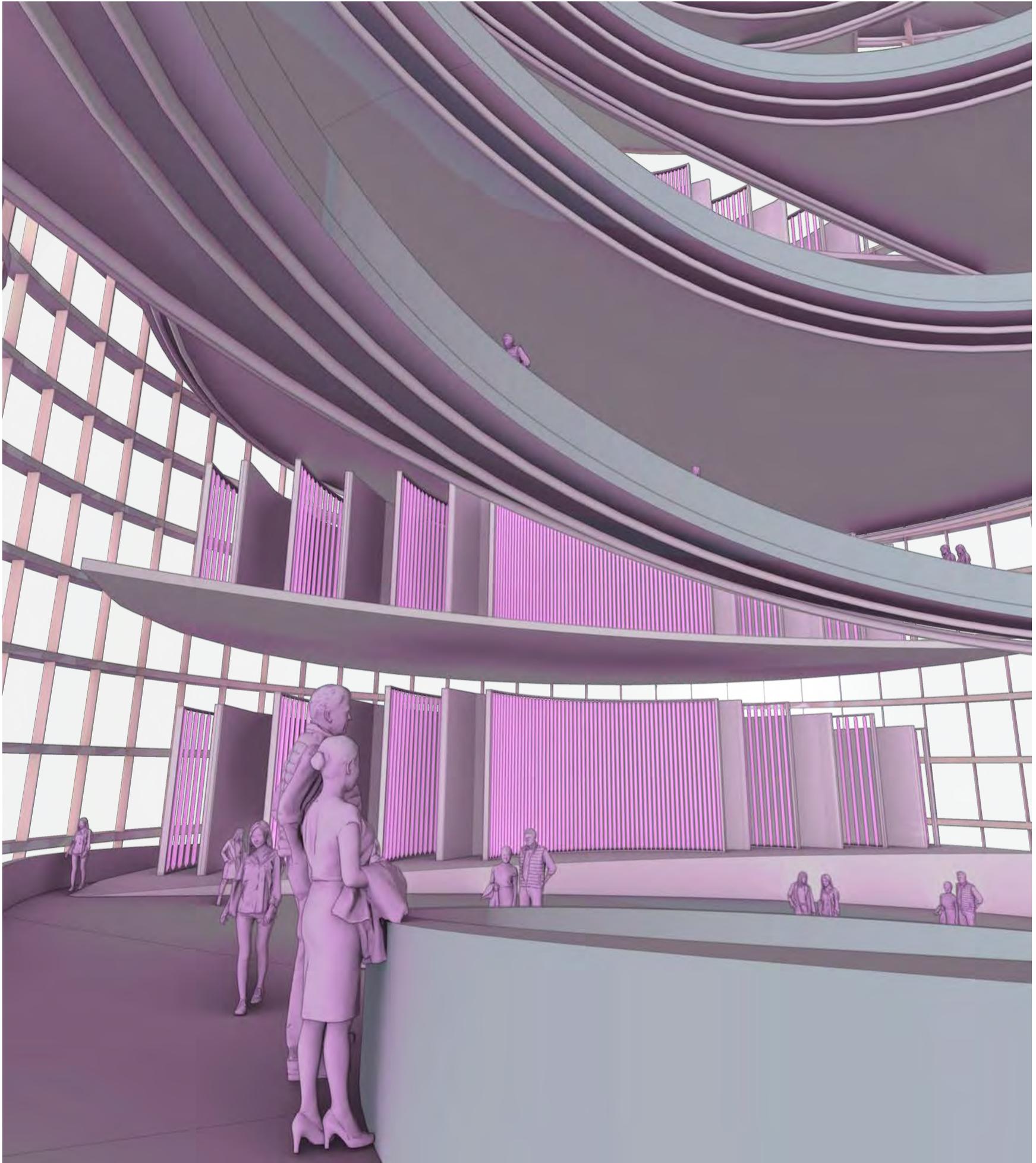
BOTTLING



The bottling part of the process runs alongside the public ramp that circles up through the building. This allows for continuous transparency regarding the journey of the soybean from seed to soy milk.

VISUALISATIONS

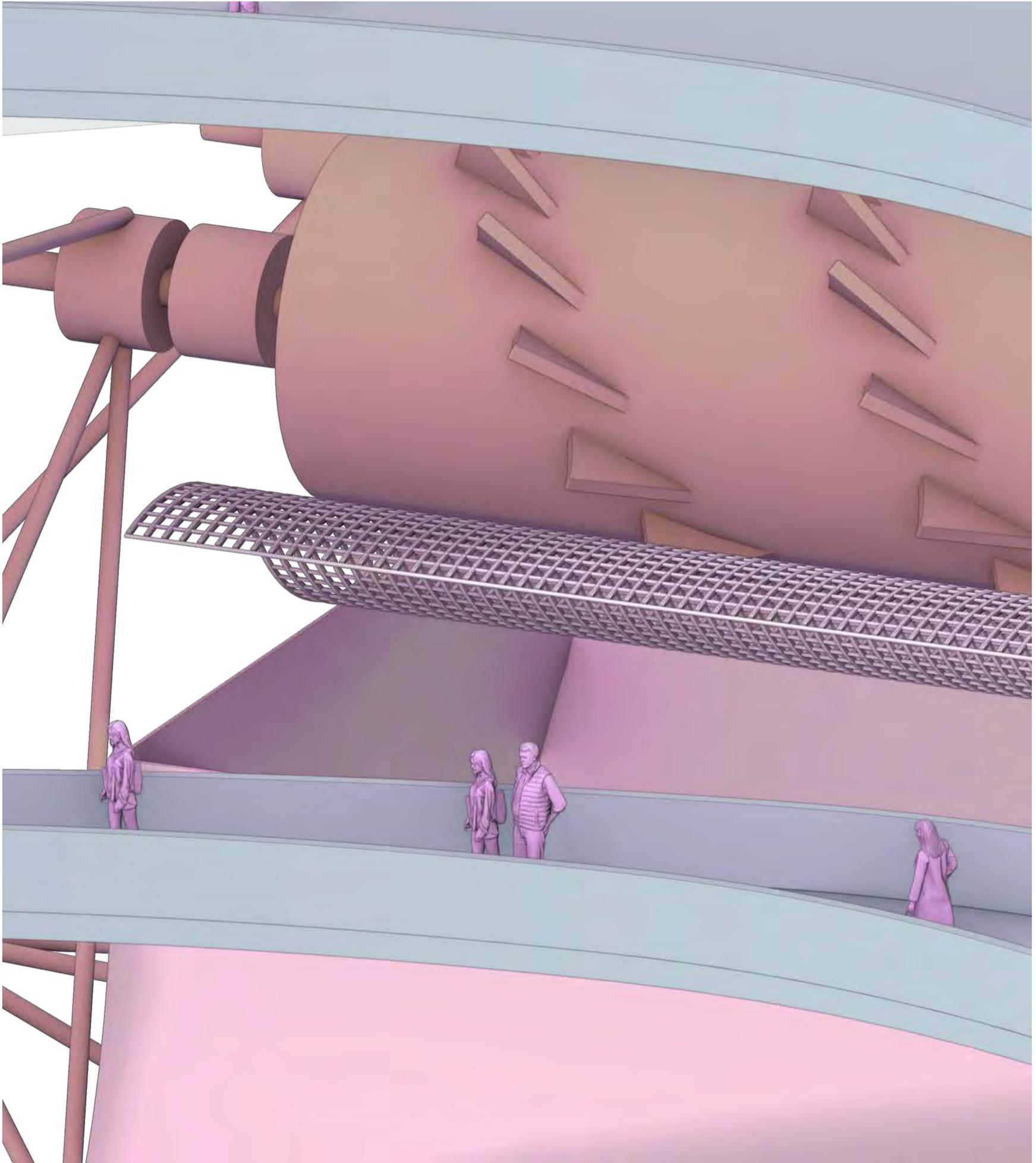
GROWING



The growing spaces can be seen at several points when walking up the ramp. The pink LED lights remain on throughout both night and day, lighting up the top of the vertical farm.

VISUALISATIONS

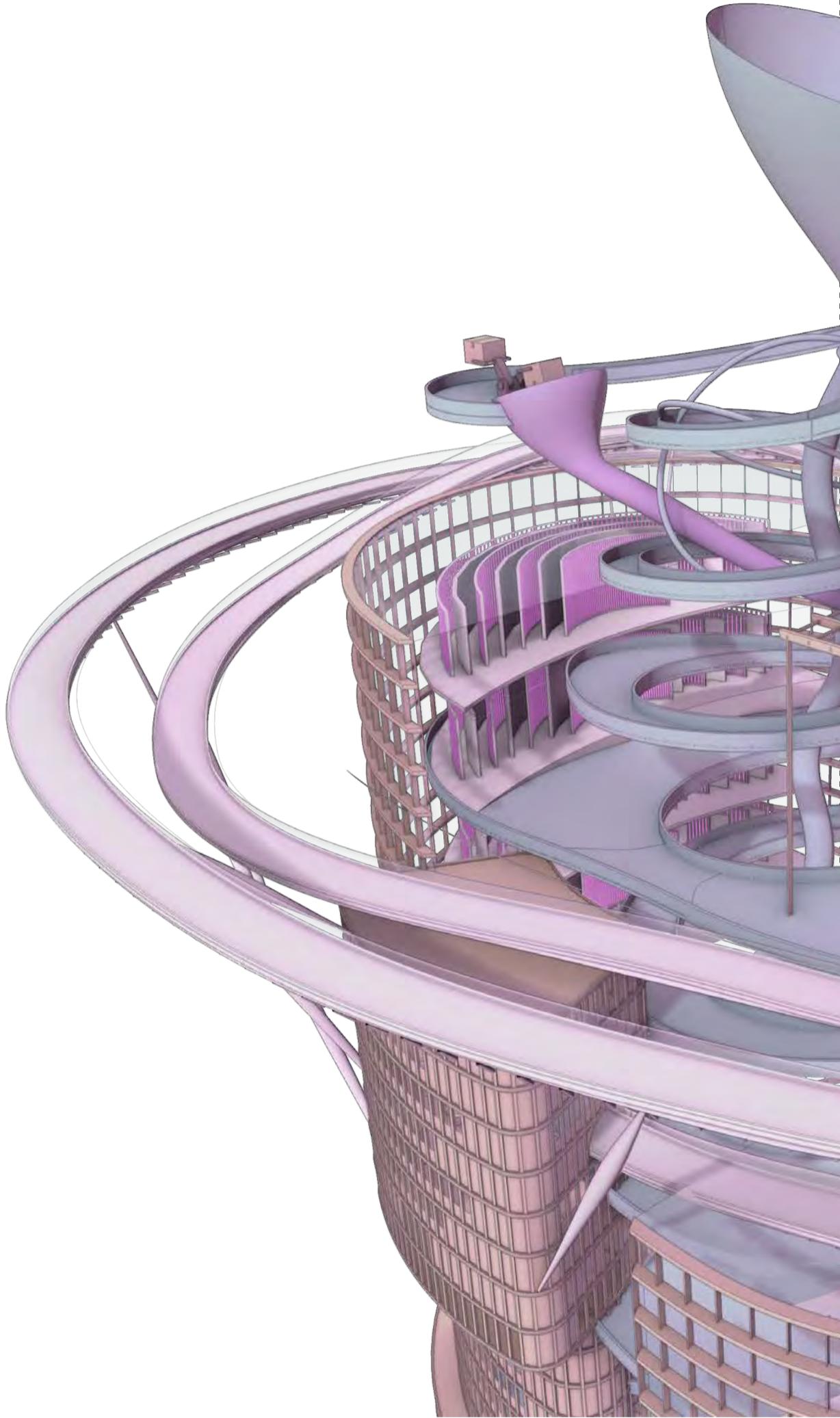
HARVESTER



The machinery for harvesting can also be observed from the spiralling walkway. This allows continued transparency with regards to how SoyScape will operate in order to produce the soy products.

VISUALISATIONS

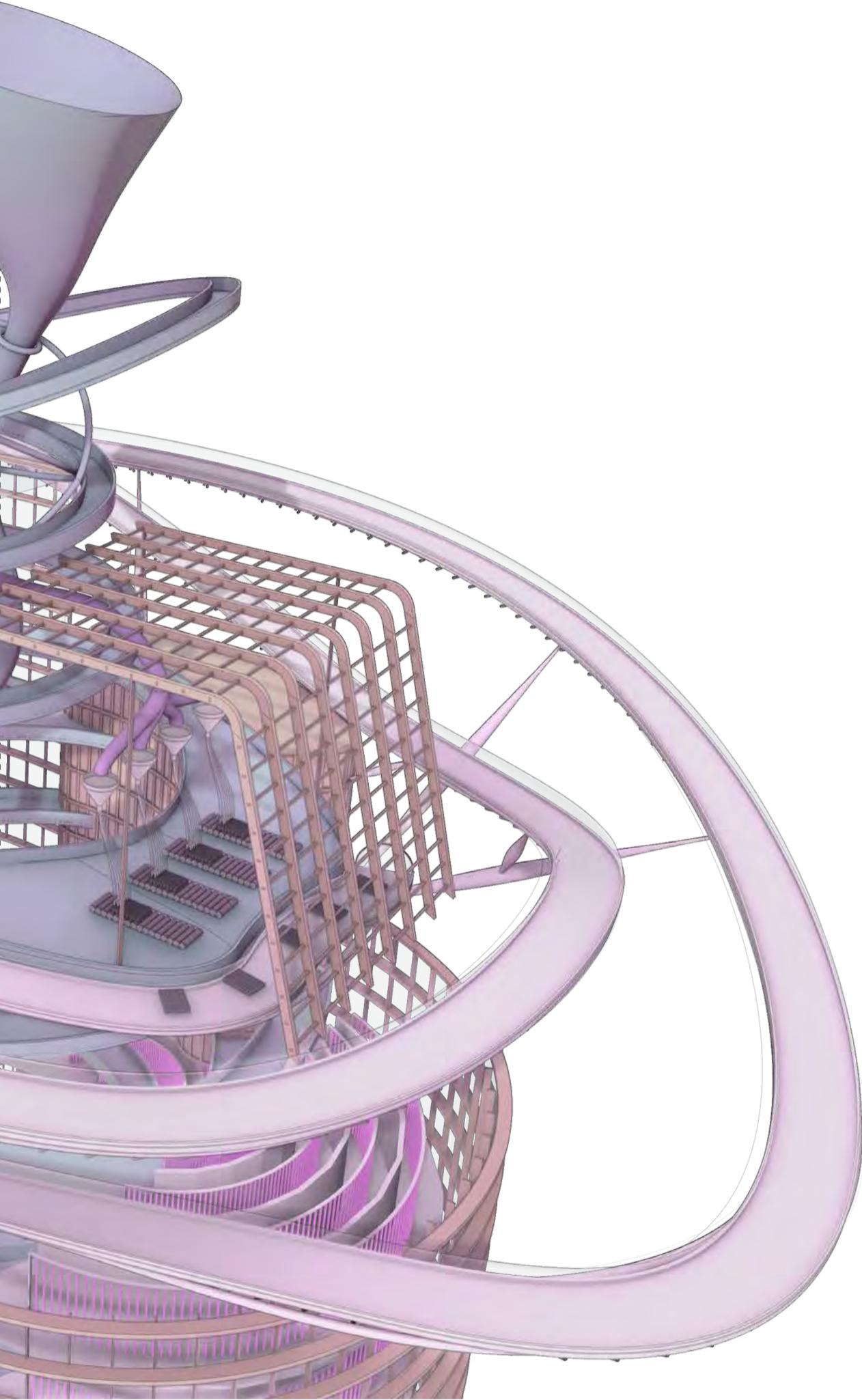
THE TOP



The top is where the farm begins. The drone delivery space, seed planting and germination all take place at this level. The germination tube provides the perfect environment for the seeds to germinate quickly.

VISUALISATIONS

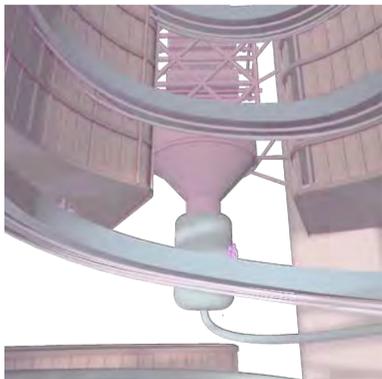
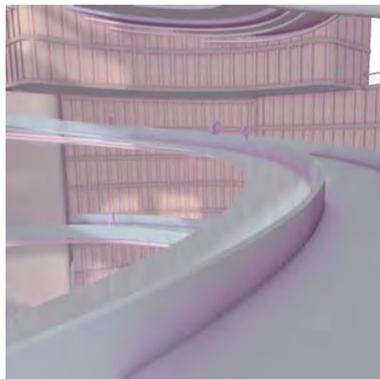
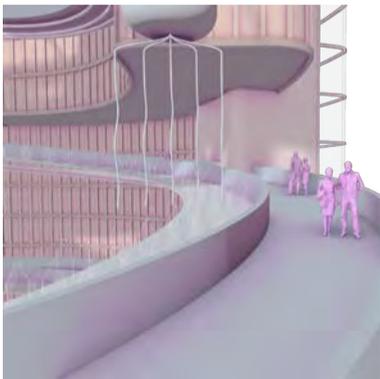
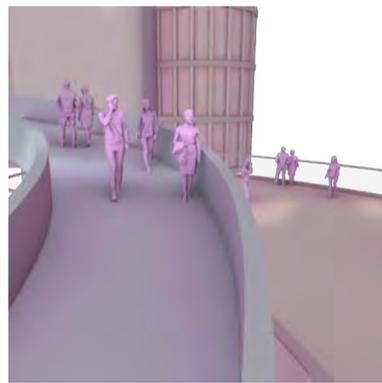
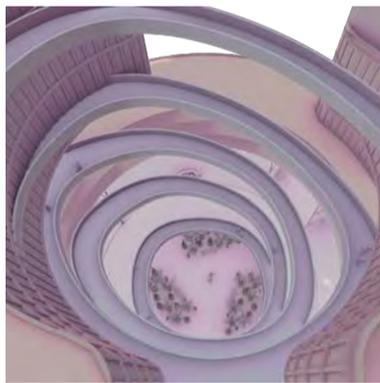
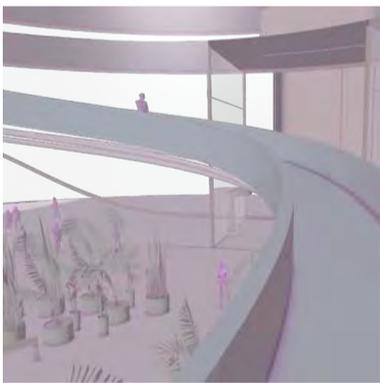
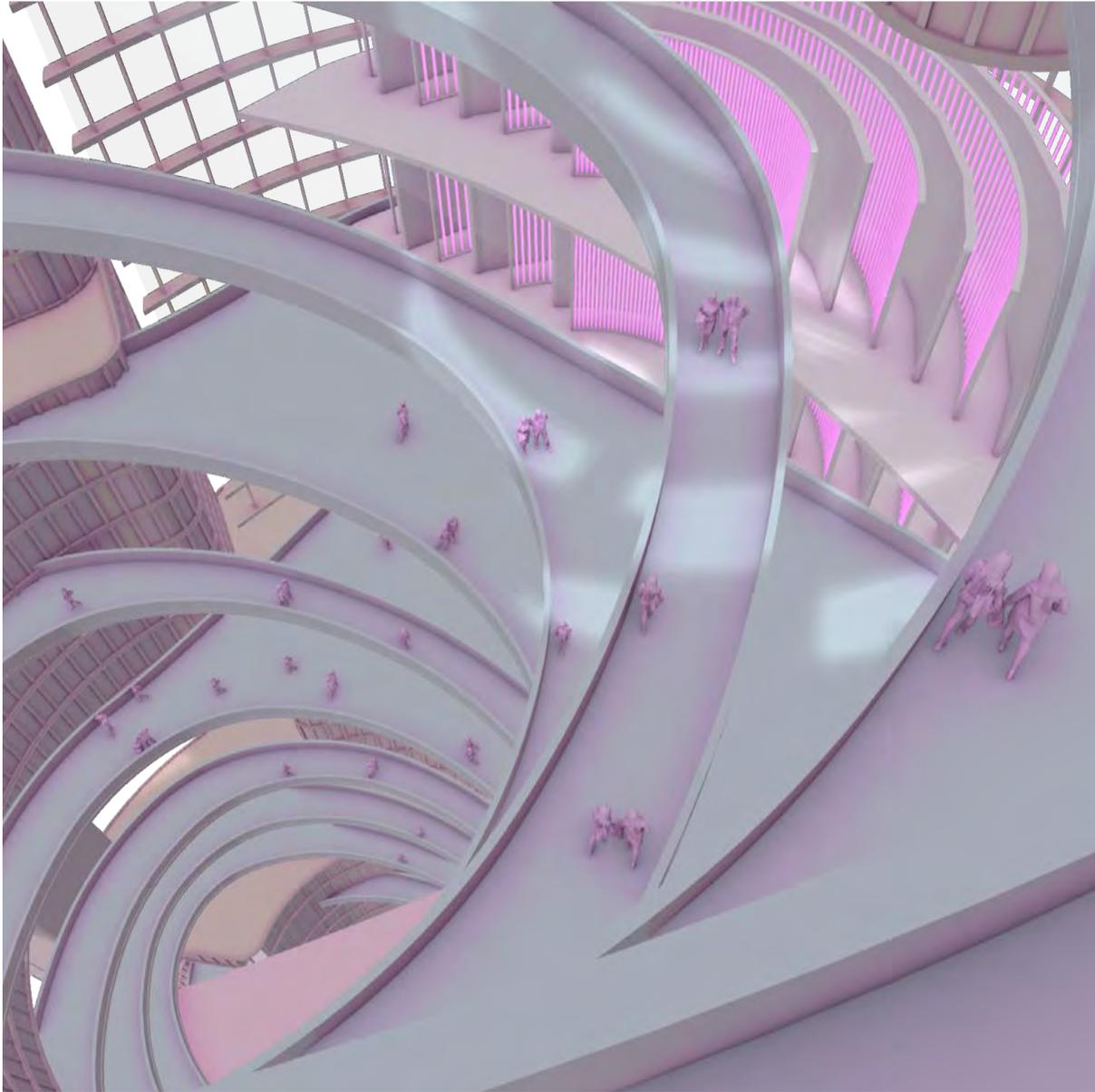
THE TOP



These processes take inspiration from vertical farms using AI and automation to plant, grow and process their produce. Little human interference is required to begin the growing process.

VISUALISATIONS

JOURNEY UP THE RAMP



VISUALISATIONS

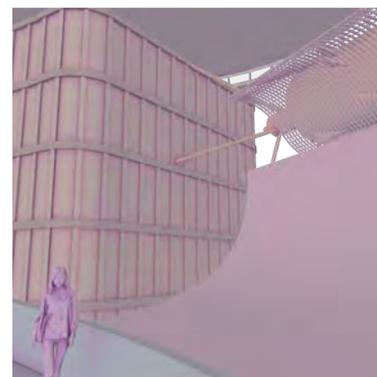
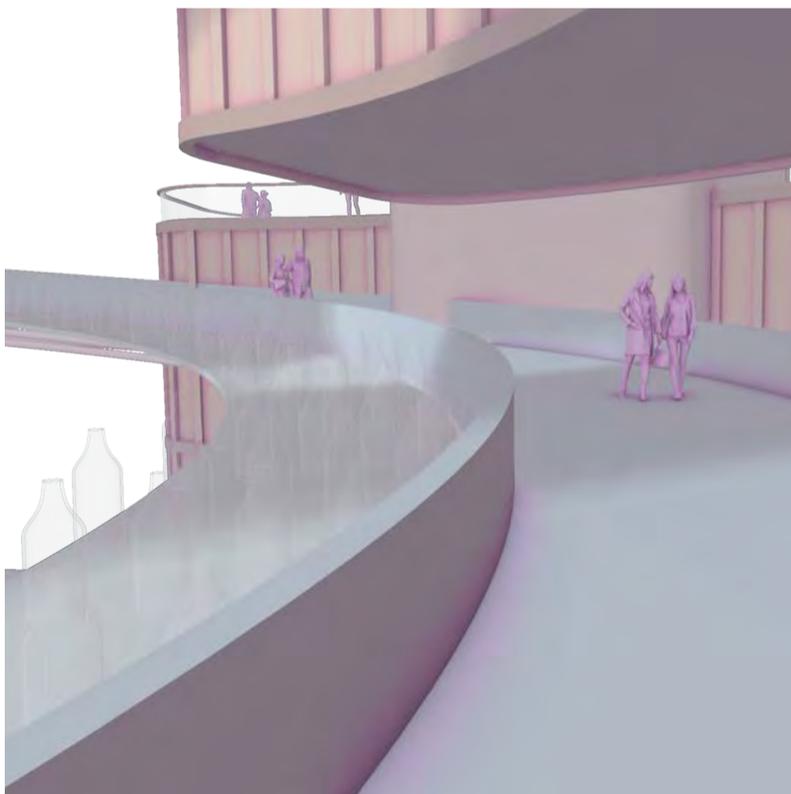
JOURNEY UP THE RAMP



The ramp is the key element of the SoyScape high rise. It allows people to reconnect with nature as they travel between the floors of the building by providing access and views to green spaces and the vertical farm.

Through this, it demonstrates to visitors the journey of our food before it arrives in the shops or on our plates and reminds them how much we rely on a steady supply of food all year round.

Having green spaces intertwined with other public spaces helps create an environment that has a positive impact on those visiting the building. The growing spaces work towards sustaining city life whilst also providing a glimpse of nature that humans appreciate, especially in an area where there is little greenery to enjoy.



VISUALISATIONS

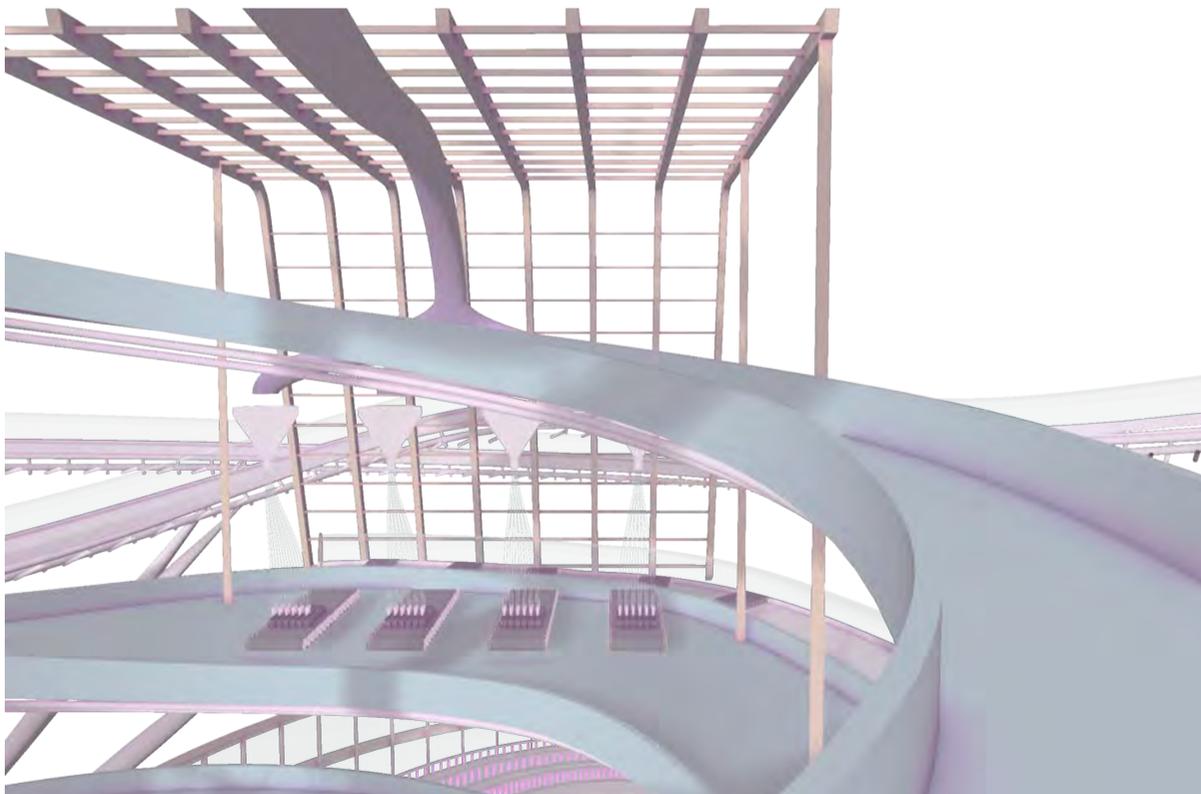
JOURNEY UP THE RAMP



The manifesto that sparked the start of this project stated that garden spaces are essential, people need to be more aware of our reliance on nature and that we need to become more connected with nature again in order to regain a strong appreciation for it.

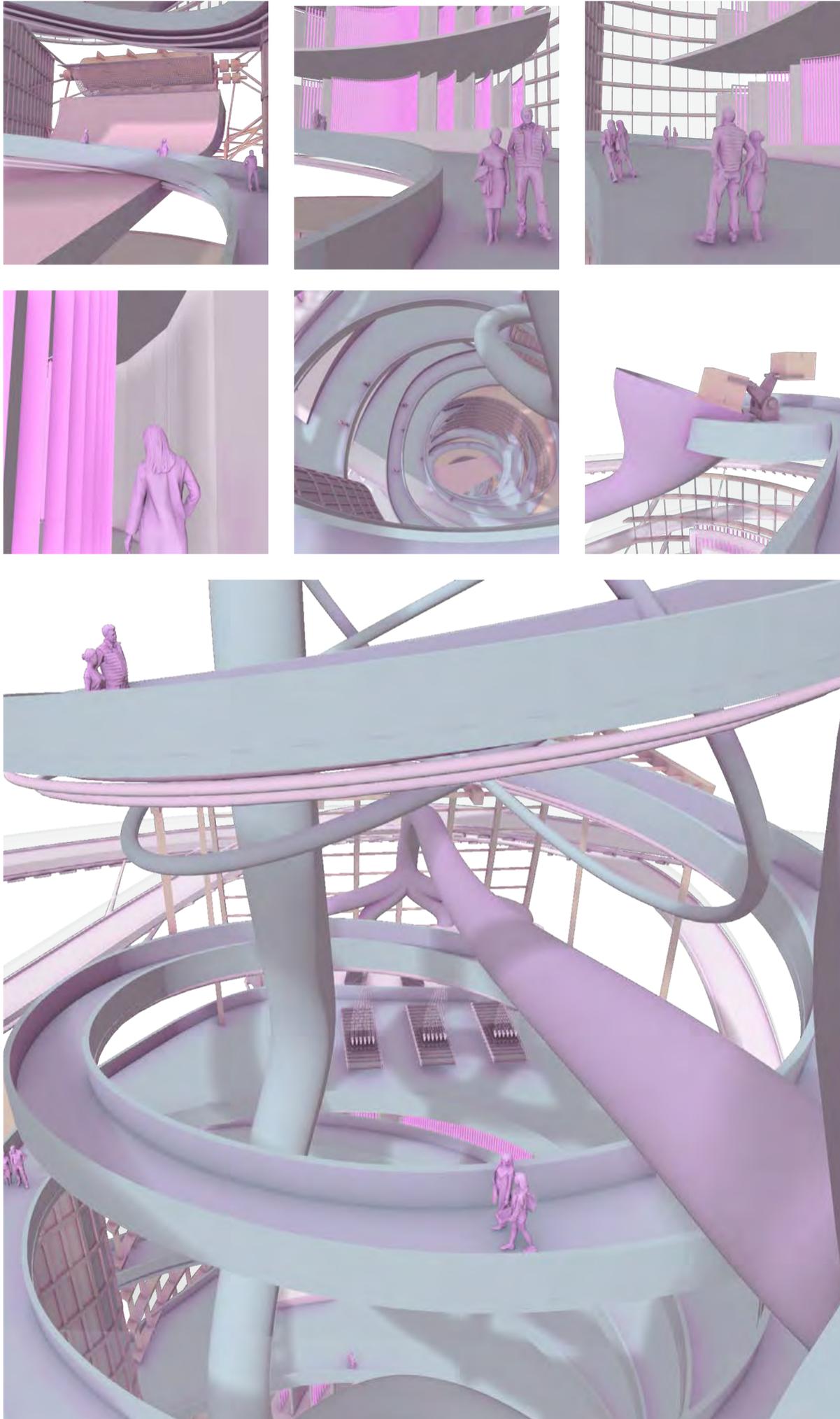
This building achieves all of these things by allowing the public to come into direct contact with the processes that take place in order to provide the food they eat. It reconnects people with nature in more than one way, providing open green spaces for the public to enjoy.

SoyScape also aims to tackle issues raised in the manifesto surrounding our current impact on the environment by reducing the food miles of the soy milk and tofu produced from approximately 6,000 miles down to just 300 meters.



VISUALISATIONS

JOURNEY UP THE RAMP



ON SITE

SOUTH WEST



SoyScape stands at 300m and, therefore, taller than the buildings around it with 'the Cheese grater' standing at approximately 260m and 'the Gherkin' at 180m.

ON SITE

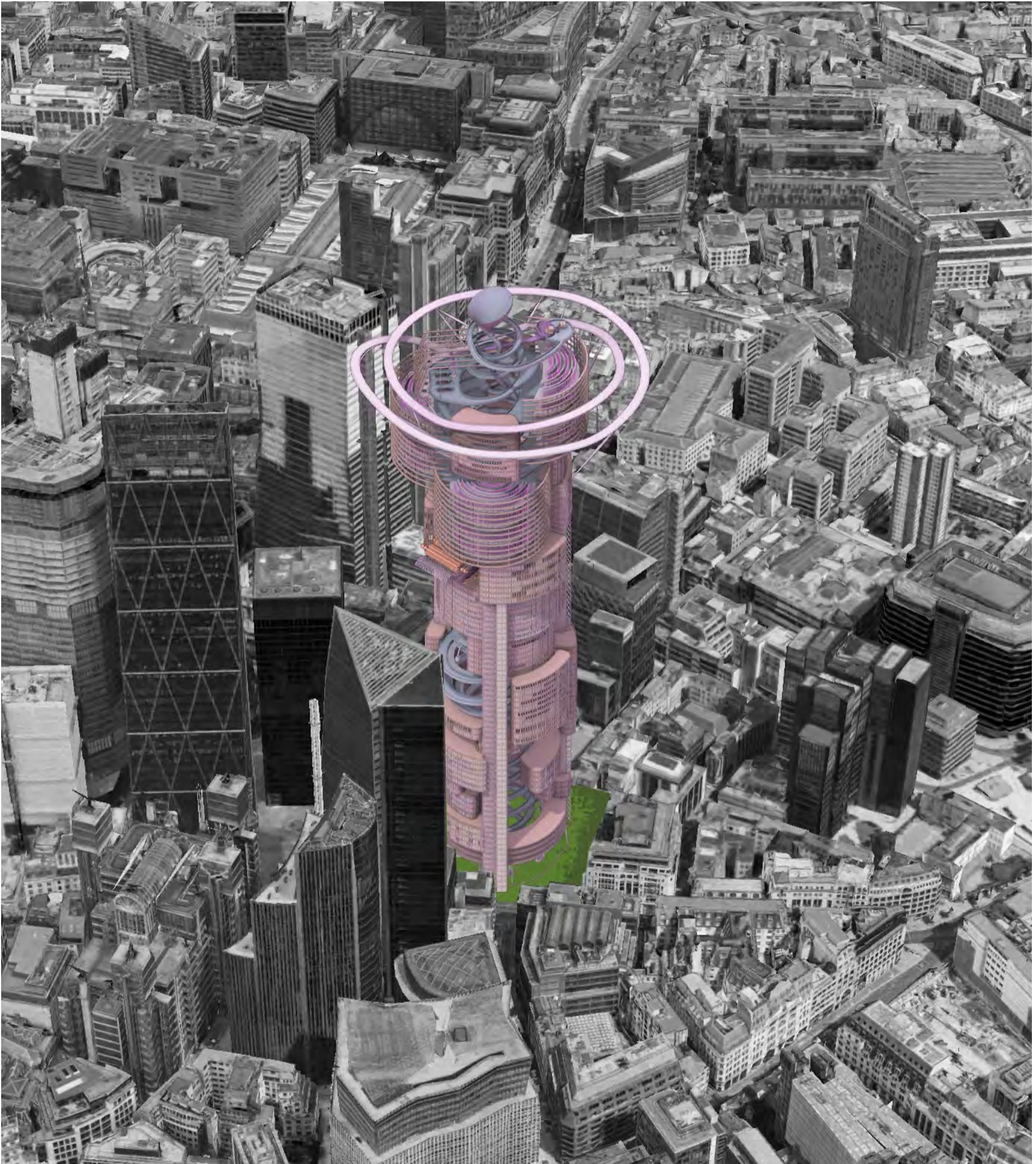
SOUTH ELEVATION



SoyScape contains the spaces necessary to grow soybeans and the elements to convert them into products that people consume daily, such as soy milk.

ON SITE

SOUTH



It provides the City of London with more public green spaces with the hope of making the area a better place to work and attract Londoners and tourists at the weekends.

ON SITE

EAST ELEVATION



SoyScape hints towards what could be possible today with the right technology and ideas. Could vertical farms sustain London life whilst providing an opportunity to reconnect with nature?

